POPULAR WOODWORKING

simply-built cabinets

PLAN • BUILD • INSTALL • ***The easy way to great results***

Danny Proulx

simply-built cabinets

Danny Proulx

POPULAR WOODWORKING BOOKS
CINCINNATI, OHIO
www.popularwoodworking.com

 Published by Popular Woodworking Books, an imprint of F+W Media, Inc., 4700 East Galbraith Road, Cincinnati, Ohio, 45236. (800) 289-0963 First edition.

Distributed in Canada by Fraser Direct
100 Armstrong Avenue
Georgetown, Ontario L7G 5S4
Canada

Distributed in the U.K. and Europe by F&W Media International, LTD
Brunel House, Forde Close
Newton Abbot
TQ12 4PU
UK
Tel: (+44) 1626 323200
Fax: (+44) 1626 323319
E-mail: enquiries@fwmedia.com

Distributed in Australia by Capricorn Link
P.O. Box 704
Windsor, NSW 2756
Australia

Visit our Web site at www.popularwoodworking.com.

Other fine Popular Woodworking Books are available from your local bookstore or direct from the publisher.

15 14 13 12 11 5 4 3 2 1

ACQUISITIONS EDITOR: David Thiel
DESIGNER: Brian Roeth
PRODUCTION COORDINATOR: Mark Griffin
PHOTOGRAPHERS: Danny Proulx, Michael Bowie, LUX Photographic Services, Inc.
ILLUSTRATOR: Len Churchill

READ THIS IMPORTANT SAFETY NOTICE

To prevent accidents, keep safety in mind while you work. Use the safety guards installed on power equipment; they are for your protection.

When working on power equipment, keep fingers away from saw blades, wear safety goggles to prevent injuries from flying wood chips and sawdust, wear hearing protection and consider installing a dust vacuum to reduce the amount of airborne sawdust in your woodshop.

Don't wear loose clothing, such as neckties or shirts with loose sleeves, or jewelry, such as rings, necklaces or bracelets, when working on power equipment. Tie back long hair to prevent it from getting caught in your equipment.

People who are sensitive to certain chemicals should check the chemical content of any product before using it.

Due to the variability of local conditions, construction materials, skill levels, etc., neither the author nor Popular Woodworking Books assumes any responsibility for any accidents, injuries, damages or other losses incurred resulting from the material presented in this book.

The authors and editors who compiled this book have tried to make the contents as accurate and correct as possible. Plans, illustrations, photographs and text have been carefully checked. All instructions, plans and projects should be carefully read, studied and understood before beginning construction.

Prices listed for supplies and equipment were current at the time of publication and are subject to change.

METRIC CONVERSION CHART

TO CONVERT	TO	MULTIPLY BY
Inches	Centimeters	2.54
Centimeters	Inches	0.4
Feet	Centimeters	30.5
Centimeters	Feet	0.03
Yards	Meters	0.9
Meters	Yards	1.1

ABOUT THE AUTHOR

For over 15 years, Danny shared with us his passion for woodworking through his books, magazine articles and website advice, as well as through teaching and mentoring his students and clients. He founded Rideau Cabinet in 1989 and started building kitchens and specialty cabinets. Over time, Danny married his love of woodworking and writing with his photographic skills and wrote 15 books during a period of 9 years. He also wrote for several magazines including *Canadian Woodworking* and *CabinetMaker Magazine*. He started giving seminars in his home for new woodworkers and eventually started teaching courses at Algonquin College in Ottawa, Ontario.

Preface

Danny Proulx was a multi-faceted individual who knew how to build cabinets and furniture and could write clearly and concisely, while at the same time sounding like he was right there in your shop giving you instructions.

Much of Danny's business was dedicated to building cabinetry, and he was very good at his business. Keeping it simple is what this book is all about. The projects in *Simply-Built Cabinets* can be made using basic power woodworking tools: a pocket-hole drilling jig, a biscuit joiner, a table saw and a drill press. Plus, some hand tools: a chisel, cordless screwdriver, hammer, etc.

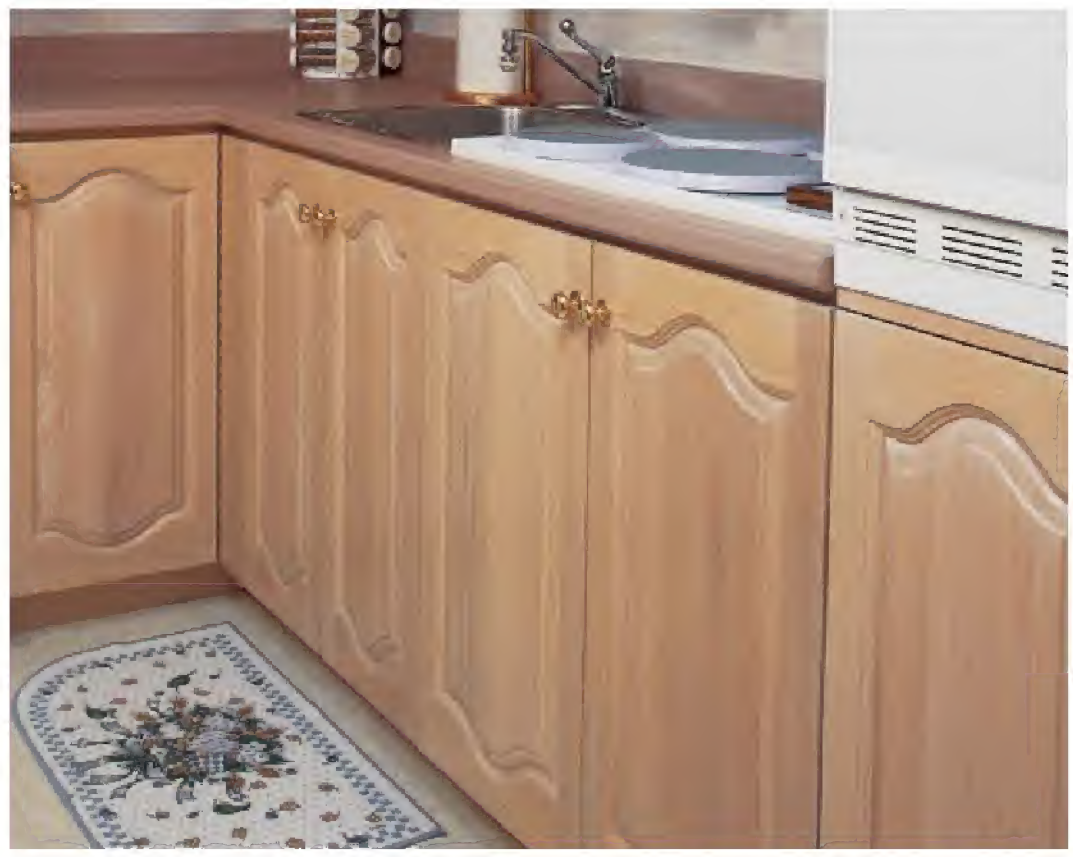
Several of the projects are built in sections that are then assembled to create the final piece. This can serve several purposes. It's easier to transport several small parts than one big one and, if you have a small woodworking shop like most of us do, you will appreciate having to build only one or two pieces of a project at one time. When these are finished, then can be moved to create more room in your shop so you can continue building.

The materials for these furniture projects can be found at most home centers. Danny designed his projects so the materials can simply be cut to size and assembled. You don't need a planer or jointer to prepare the hardwood parts. The sheets goods can be cut to size using several different tools. A table saw is best, but a straightedge used with a circular saw will get the job done too. And, if all you have is a jig saw, well, that will work also.

Danny preferred tools with cords and batteries, because they are efficient and he could get more work done in a shorter amount of time. If you are able to only work weekends on your woodworking projects, power tools are your best friends — your work will progress quickly and efficiently.

Simply-Built Cabinets will give you the information and insight to build cabientry for multiple rooms in your home, all in a simple and understandable manner. That's what Danny did best.

table of contents



introduction

Cabinetmaking, like many other skills, requires nothing more than attention to detail and patience. This skill is learned and improved upon with practice and, I believe, is well within the scope of most home woodworkers.

The cabinetmaking style detailed in this book is a simple, straightforward style used by many cabinet manufacturers, with some minor variations. Common dimensions such as cabinet depth, height and width, are detailed, as well as simple rules to calculate door widths. As you will see in later chapters, the normal depth for a base cabinet is 24", upper cabinets (when used in conjunction with base cabinets) are approximately 12" deep, and the space between the upper and lower cabinets is from 16" to 18".

This building style was adapted from many sources. Primarily, it's a blend of the best features of European– and North American–style cabinetry. The carcass, or cabinet, is built with ⅝" or ¾" melamine-coated particleboard (PB) or veneered sheet materials. I have offered information on both the face frame and European frameless cabinet design. Adjustable legs are offered as an option, installed on the base cabinets, to maximize the cutting from a sheet of PB and to allow for easy installation.

The hidden hinge is another European innovation used because of its strength, durability and ease of adjustment. The building system is logical and extremely adaptable to all situations, and the end result equals the best cabinets available on the market.

Building cabinets requires basic woodworking skills along with some of the power and hand tools most woodworkers own. Power tools include a table saw, circular saw, router and drills. Tools such as a radial-arm saw, power screwdrivers and power sanders are always handy but not absolutely necessary. Obviously, the more tools you have and the more experienced you are with these tools, the easier it will be to build cabinets. However, the end result is dependent on the care and attention to detail that you put into the project and not primarily on the tools you own.

The most important piece of advice that I can give anyone involves the planning and cutting of the cabinet parts. Take your time to plan the cutting process and accurately cut all the parts to the correct size. The assembly and final finishing will be simple if the cabinet pieces are accurately cut.

Today the focus of activity in the home is the kitchen or family room. We seem to be reverting to earlier times when the kitchen was a large meeting place for family and friends, as well as a place to prepare meals. New homes are being designed with larger kitchens and family or great rooms (as they are sometimes called), to meet those desires. Renovation projects involving the kitchen require more space be allocated, or at

the very least, the use of light–colored or natural wood cabinets, to make the room seem larger.

Years ago kitchen cabinets were built without too much thought about interior use and function. Shelves were fixed in place and finished with a coat of paint. Most cabinets required the homeowner to paint the kitchen walls that could be seen inside the cabinets and cover the shelves with paper.

Today, modern cabinets are fitted with drawer pullouts, lazy Susans, pullouts in lower cabinets, multiple drawer assemblies, wall ovens, built-in cooktops and all the other features that make today's kitchen an exciting place to work and gather with friends.

Family room cabinetry is also more specialized with concerns for audio-visual components, flat-screen TVs and, of course, computers.

With this book you can build beautiful, quality cabinetry for any room in your house. If you really enjoy the building process, you can open your own part-time or full-time cabinetmaking business. The choice is yours. There certainly is enough work to go around for the quality cabinetmaker.

designing & building cabinets

While there are many reasons to build cabinetry for your home, the number one reason falls to the kitchen, the heart of any modern home. The principles used to build cabinetry apply to both kitchen and other cabinetry, but because of the importance of the kitchen, I want to start here.

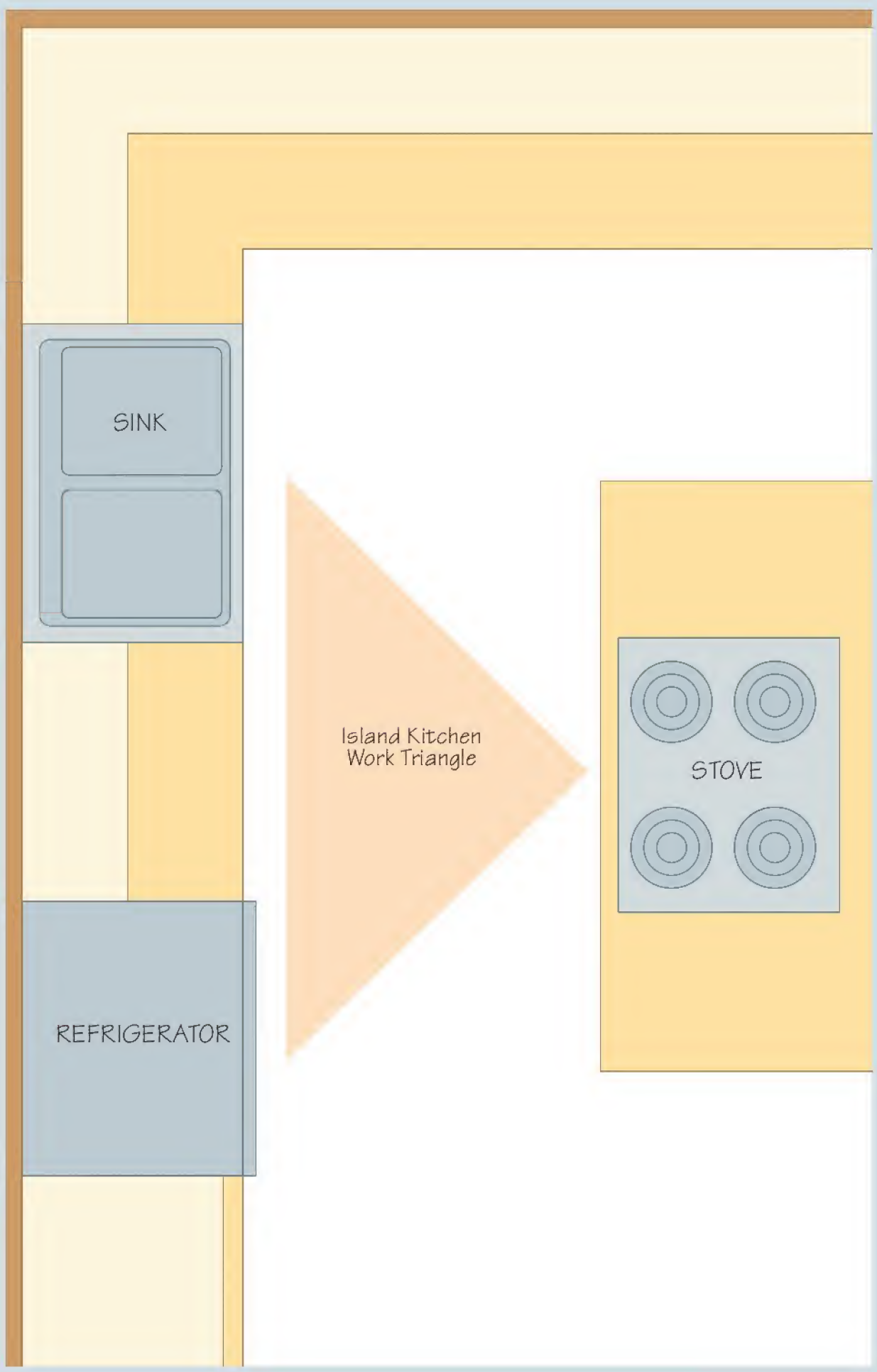
Planning Your Kitchen

This book is about building cabinetry, but when planning to build kitchen cabinets, there are topics that should be addressed. There are numerous books dedicated to only kitchen cabinetry, and they will cover these topics in greater depth. However, I think it appropriate to mention a few important concerns.

No renovation is more disruptive to a family's lifestyle than a major kitchen renovation project. Most family members spend a great portion of their time at home in the kitchen. This important room is used to prepare meals, for informal eating and as a casual gathering place for family and friends. People soon realize how important the room is when it's torn apart during renovations; even the simple task of making a cup of coffee becomes a major undertaking without a kitchen.

It's critically important that tear-out and new cabinet installation are coordinated during the design phase to minimize downtime. The last thing you want to tell someone is that the kitchen will be down another week because you forgot to order something or your dimensions were wrong and you have to rebuild a cabinet.

Kitchen design is subjective. Few hard and fast rules exist. A feature or layout that is perfect for one person is far from perfect for another. Kitchen layouts include many styles, such as the L-shaped, galley, U-shaped and island styles. Most kitchen designers use a work triangle (see illustration) formed by distances between the refrigerator to the stove to the sink and back to the refrigerator. The sum of the legs in the work triangle should not be less than 10' and not greater than 25'. If this sum is too small, people will be tripping over each other, and if too large, food preparation could be a tiring task.



Defining Your Needs

1. Discuss the existing kitchen space and layout, listing the good and bad points of the design.
2. Investigate the traffic patterns.
3. Analyze daily meal preparation tasks.
4. Ask questions about your family's desire to do more in the kitchen if the added space were available?
5. Do you walk or move a lot during meal preparation?
6. Is cleaning up after meals difficult or inconvenient?
7. Do you want to entertain more in the kitchen?
8. How long do you plan to own the house? Will the money required be a good investment, or does it matter?
9. If space or money were no object, what would you like to have in your dream kitchen?
10. Discuss lighting, area and task illumination, kitchen seating needs, as well as appliance upgrade needs.

Cabinet Construction System

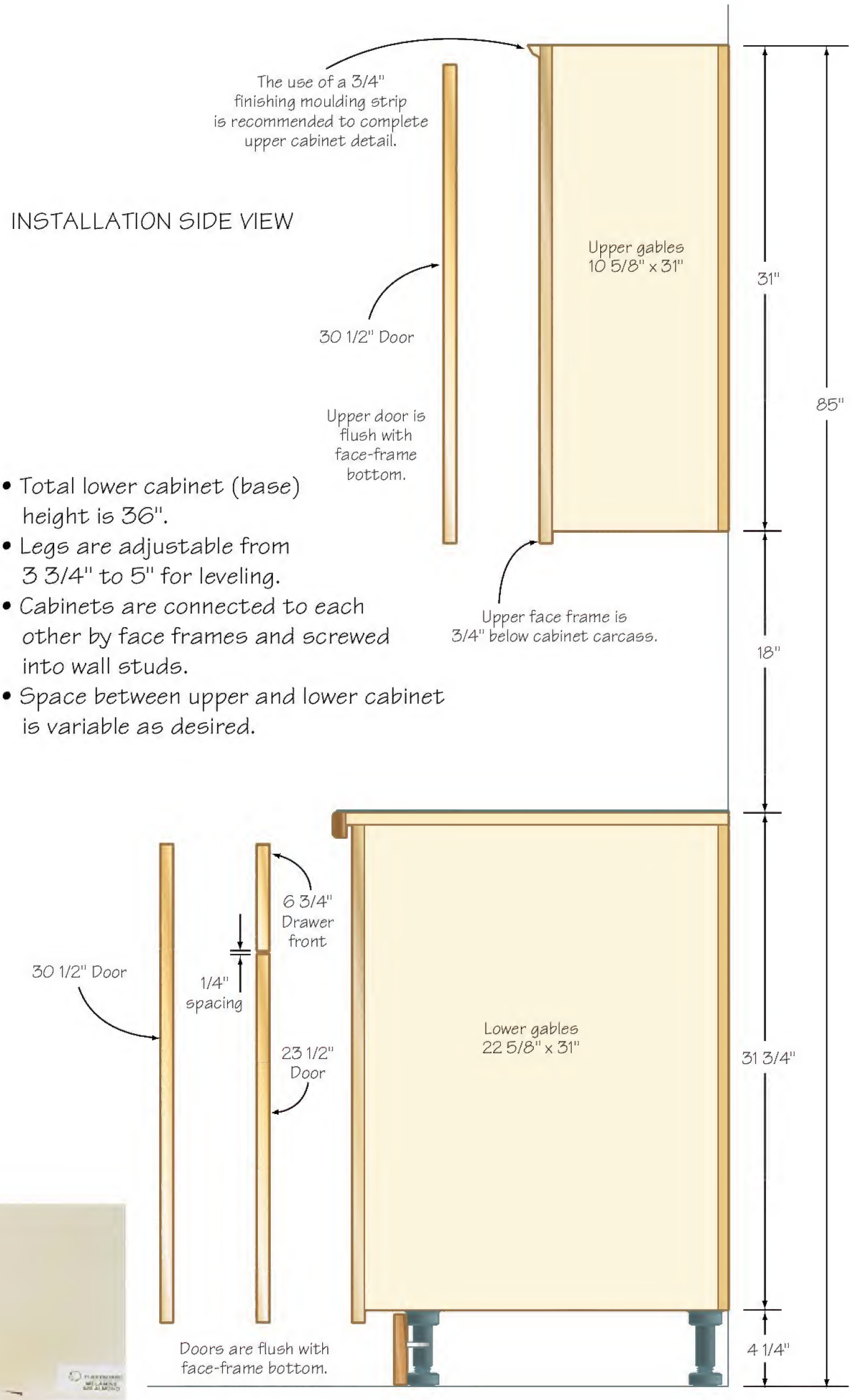
The cabinet design detailed in this book is a modular blend of European and North American cabinet construction methods. The final product, once installed, looks more traditional because of the use of the face frame on the cabinet. (The main difference between North American traditional and European-style cabinetry is the use of the face frame.) European cabinetry, in general, uses the same carcass style as is used in this design, after which the exposed carcass edges are covered with veneer tape or a laminate.

The modular cabinet box (carcass) is the heart of this system.

The cabinet uppers and bases are built with ⅝"- or ¾"-thick melamine particleboard (PB). The backs are a full ⅝"- or ¾"-thick particleboard. Base and upper backing allows easier installation, a tighter cabinet and eliminates the need to paint the walls inside and behind the cabinets.

Modifications or special cabinet material can be substituted when the need arises. These include using wood-veneer-covered PB for microwave, pantry or glass door cabinets whose interiors will be exposed. This cabinet design is so flexible that almost all special situations can be addressed with only minor changes.

Various composite boards and hardwoods are used to build the cabinets. Shown are melamine particleboard, wood-veneer-covered particleboard, veneer plywood and hardwood for the face frames.



LEFT The doors for this kitchen were made using ¾"-thick oak-veneer particleboard with taped wood-veneer edges. **BELOW** Painted medium-density fiberboard (MDF) doors are a low-cost option. A new and popular option is the thermofoil (plastic-covered MDF) doors.

Cabinet Doors — Building or Buying?

For years, prior to this kitchen cabinet design system, I made my own doors. The door styles are numerous, and I spent a great deal of time and money investing in wood shapers and bits, as well as designing and building the necessary templates. When a large kitchen renovation project requires upwards of 30 doors, construction costs are a serious consideration and can affect the profit line. In the case of solid doors, labor for gluing up blanks, shaping and cutting adds up quickly. More often than not, the next client wants a totally different door style!

For this reason, I now normally purchase factory-made doors. The companies that supply doors are numerous, their lines are varied, the cost is attractive, and you have an almost unlimited choice of door styles.

You may want to design and build your own doors, however, particularly if time is not an issue. I'll detail the process for building your own doors later in this book.

Five-piece wood cabinet doors with solid raised panels are the most expensive door style. Substituting the solid-wood core for a ¼"-thick veneer plywood center panel can reduce the price.

Cabinet Design

These cabinets have been designed without a center stile. Therefore, when the cabinet doors are open, in the case of a two-door cabinet, you have complete access to the interior.

This is made possible by the use of the fully adjustable European hinge. Each of the doors can be adjusted so that there is a 1/16" gap between them when closed. European hinges are installed on each door in a 35mm hole drilled on the inside of the door.

The cabinet sides, also called the gable ends, of the standard upper and base cabinets are the same length at 31" long. Only the widths are different: 10 5/8" wide for the uppers and 22 5/8" wide for the base units with 5/8"-thick PB. These dimensions allow for maximum use of a 4' × 8' standard sheet of melamine-coated particleboard for carcass construction.

The melamine sheets are 97" long which gives us three sides (3 × 31" = 93" in total), and the side widths of the standard cabinet allow for four upper sides or two base sides across the 49" width of the sheet. The interior depth of the standard uppers are 10 5/8" plus the face-frame thickness of 3/4" for a total interior depth of 11 3/8" and an interior base depth of 23 3/8" using 5/8"-thick PB.

Complete access to the upper cabinet space is possible because it has no center stile. The shelves are adjustable, and the melamine interiors are easy to clean.

Carcasses are butt joined with 2" particleboard screws.

Particleboard Material

Make certain you buy cabinet-grade melamine particleboard. Investigate the supply in your area and buy the highest grade available; it is cheaper in the long run.

Most professional cabinetmakers use a cabinet-grade melamine-coated particleboard. Three main grades are available: 100, 120 and 140.

I prefer the 120-grade board for the majority of my cabinetwork with this material. However, manufacturers have different grade numbering systems, so ask for details where you purchase your material.

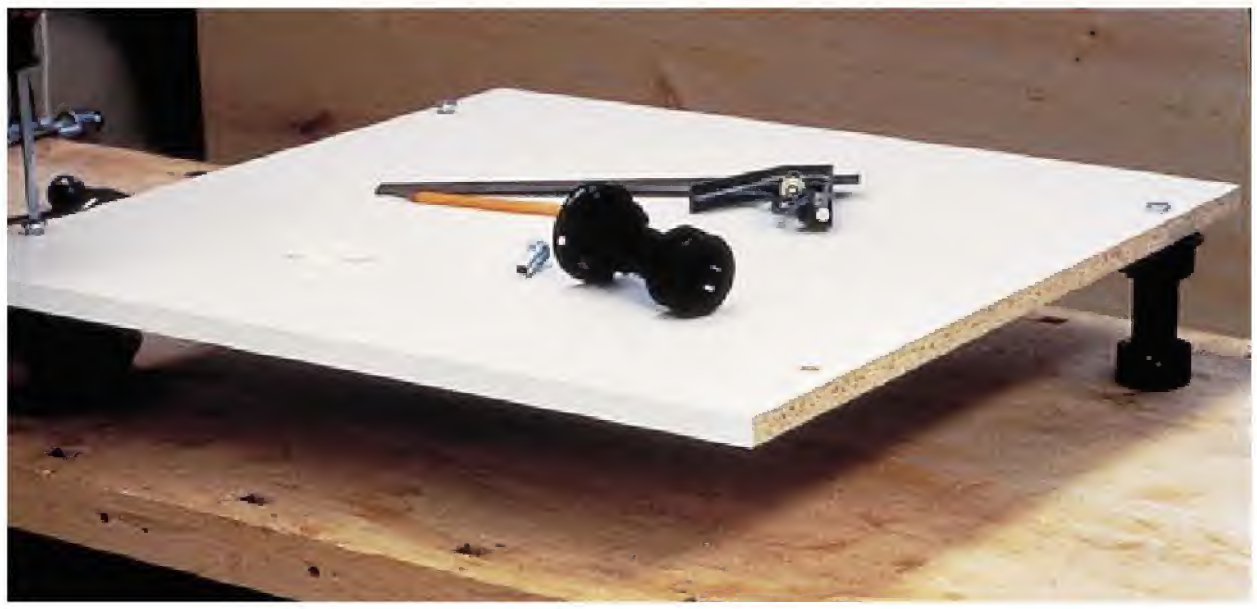
Be aware, you can find some less-expensive melamine PB on the market. While they seem like a good buy, they are more likely to scratch and break. The particles are coarse and the glue is poor. Ask for cabinet-grade material when purchasing sheet goods.

PB is formed with glue and wood particles. The melamine surface is a paper coating that has been soaked in resin and bonded to the board to make it scratch resistant.

The high glue content makes this board very hard and, as many people who use high-speed steel tools have discovered, can ruin a saw blade or tool bit quickly. It's therefore a wise investment to use carbide-tipped cutting tools when working with this material.

Additionally, screws will hold properly only if the board has been predrilled. A hole will allow the screw to cut a thread and grip tightly. Without a pilot hole, the board may split. There is a special screw for particleboard joinery. The shaft is thin and the threads are coarse. This allows the screw to cut a deep, well-defined threaded hole, forming an amazingly tight joint.

If the shelving is greater than 30" wide, I often install a 1×2 hardwood cleat, running the full width of the shelf, on the rear underside of the shelf board, for added rigidity. You can also use 3/4"-thick material for these longer shelves. The front or exposed edge of the PB can be covered with a plastic edging called cap moulding or with white iron-on edge tape. You can also face the shelf with hardwood. I normally construct full-depth base shelves to maximize the storage space of the cabinet.



Cabinet legs allow us to use 31" cabinet sides for both the upper and lower cabinets. These legs are independently adjustable and allow for a solid piece of 1×4 hardwood board to be clipped on as the kickboard. Installation is easy and accurate.

The cabinets in this system use an adjustable shelf as the standard. It provides you with an efficient and flexible cabinet. Normally, I install two adjustable shelves in each standard upper cabinet with an 1¼" (32mm) position adjustment.

Four joinery systems are used to join particleboard and plywood veneer panels. From left to right: the particleboard screw, confirmat screw, biscuit and dowel. The most common joinery system is the particleboard or chipboard screws available at most large home centers. The wood face-frame is constructed using butt joints, glue and two wood screws at each joint. Other joinery options include biscuits, pocket screws on the rear of the face frame or a mortise-and-tenon joint. This face frame is then attached to the carcass front using glue and 2" finishing nails. Nails are countersunk and the holes are covered with colored wood filler wax, making them almost invisible. If you want to avoid nailing and filling, you can use biscuits. However, under normal circumstances, the cabinet door covers the filled nail holes.

With the same cabinet construction methods you can build a variety of functional cabinets, such as the bathroom cabinet shown here.

All the standard cutting and assembly principles can be applied when building custom bathroom cabinets. The only major difference is the cabinet height, which ranges from 28" to 36". A cabinet height of 34" appears to be the most popular. Cabinets over the sink base can be 6" to 10" deep.

With base cabinets, the adjustable-leg feature of this cabinet system is a benefit in a bathroom application because of heating, plumbing and electrical installation needs. Often a problem in the confined bathroom space, they are more effectively met because of the added space under the cabinets.

Drawers

Drawers are constructed with many types of materials. Melamine particleboard is one option that can be used to build a solid, maintenance-free drawer.

Drawers are an important and integral component in any kitchen renovation project. The majority of kitchens have a four-drawer bank for cutlery and utensils, plus additional drawers in the base cabinets. Microwave cabinets with a lower drawer bank are also an extremely popular addition to the modern kitchen.

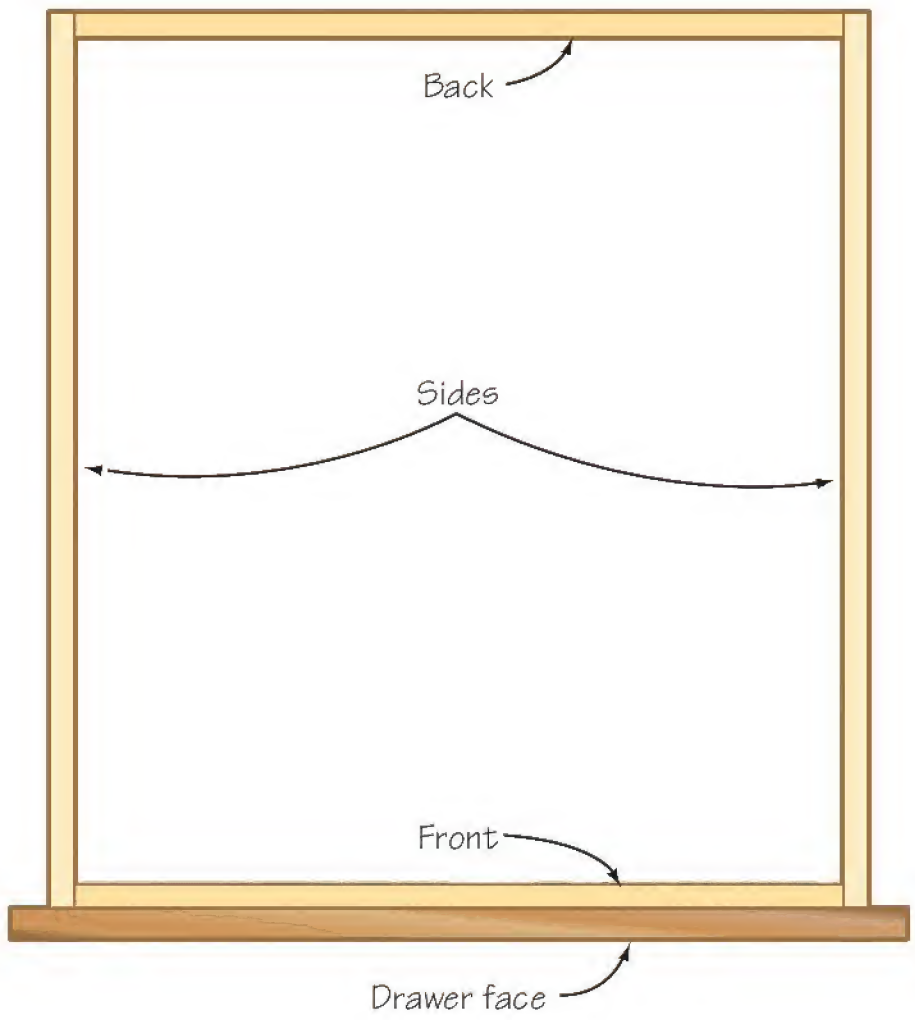
In keeping with the design of the cabinets, I wanted to construct drawers that were sturdy, reasonably priced and easy to maintain (the melamine surface is easy to clean), since the drawer would be opened and closed many thousands of times throughout the life of the kitchen. The cost of manufacturing a lot of drawers for the typical kitchen is an important issue. Solidwood drawers would be strong but expensive, so a construction method based on melamine-coated particleboard seemed to be the answer.

After cutting out the cabinet body parts, use the remaining PB and 2" PB screws to construct the drawer boxes. The exposed top edge of the melamine PB for the drawer box can be covered with matching iron-on veneer tape or with ¼"-thick solid-wood strips, which are rounded over and finished. The wood edge on the drawers is the same wood as the cabinets and is an attractive accent detail when the drawer is opened. European drawer glides are used to mount the drawers in the cabinets. A wood front is attached to the box, acting as the drawer face, and is either purchased from your cabinet door supplier or made to match the doors you are installing.

I have been using this method of construction for about eight years, and I have not had any drawer problems. The drawer carcass is heavy due to the weight of the PB material, making it operate smoothly.

Baltic birch plywood, which is sometimes called cabinet-grade plywood, and solid hardwoods to match the wood you've chosen to build your kitchen can also be used to construct drawer boxes.

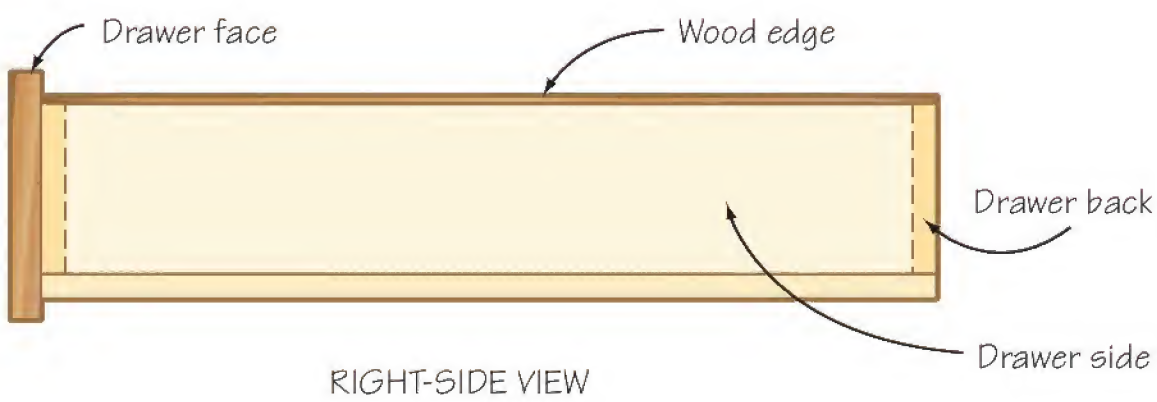
DRAWER CARCASS ASSEMBLY



TOP VIEW

Drawer Carcass and Front Assembly

- PB drawer sides are screwed to back and front boards.
- Leave side screws flush with surface to cover with plastic caps.
- Cover edge of drawer bottom board along each side with melamine tape.
- Drawer carcass is 1" less in width and 1" less in height than drawer opening.

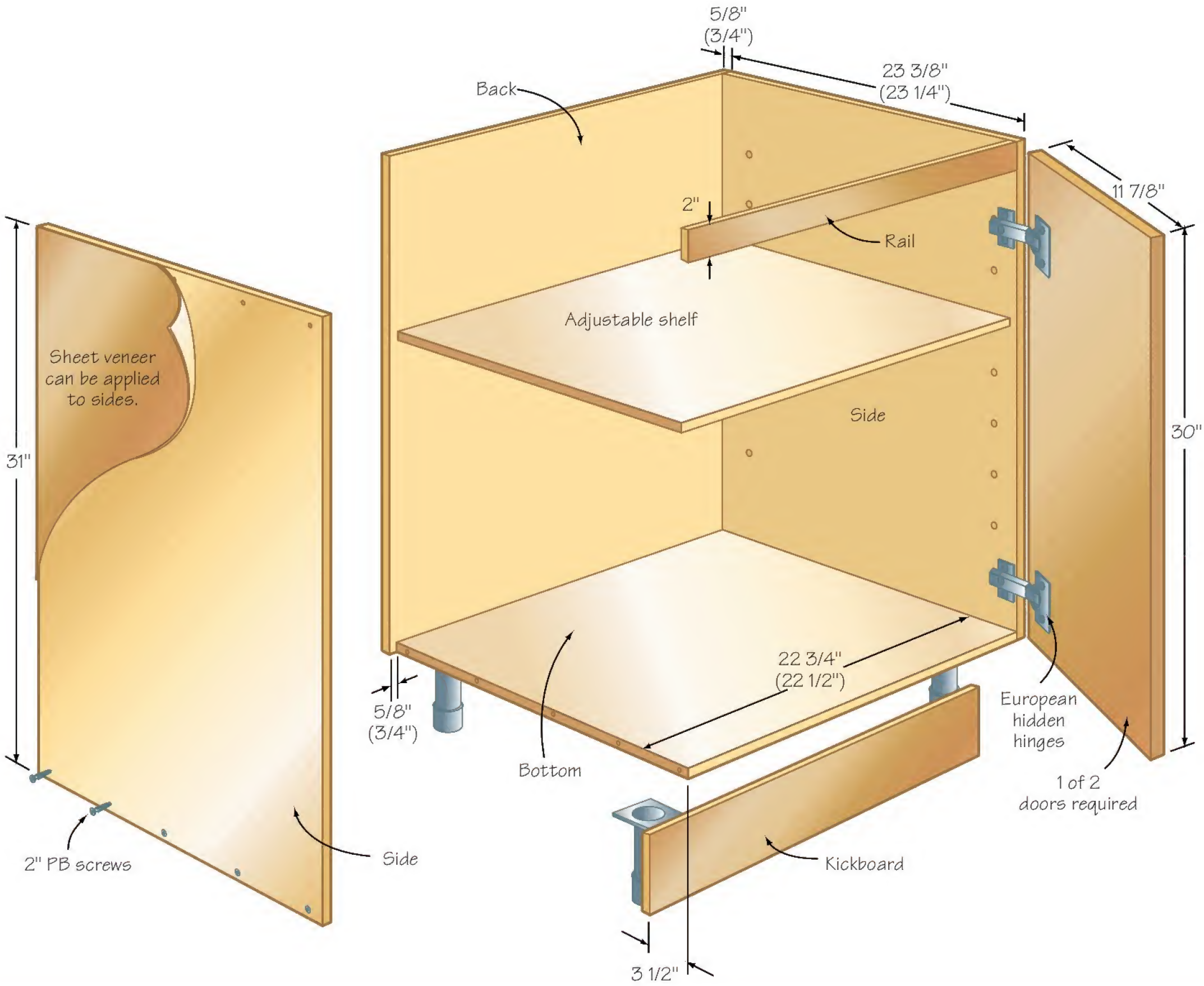


RIGHT-SIDE VIEW

Drawers are an important part of any cabinet project. The simplest drawers to make are drawer boxes with loose drawer fronts. Melamine drawer boxes are attractive and easy to keep clean, and are also easy to fit into the cabinet carcass (shown above). Once the drawers are fit, the drawer fronts (easily made in solid wood to match the face frame) are then screwed in place on the drawer box front. This is also another opportunity to make fine adjustments to align a set of drawers.

Base cabinet pullouts greatly increase the storage capacity of a cabinet and allow easy access to all the items on the shelf. They can be a ⅝" or ¾" melamine PB box, much like the drawer carcass, with a solid-wood face. A few options I've used include solid-wood pullouts with rails, melamine PB with hardwood rails and extra-deep pullouts for garbage and recycling bins.

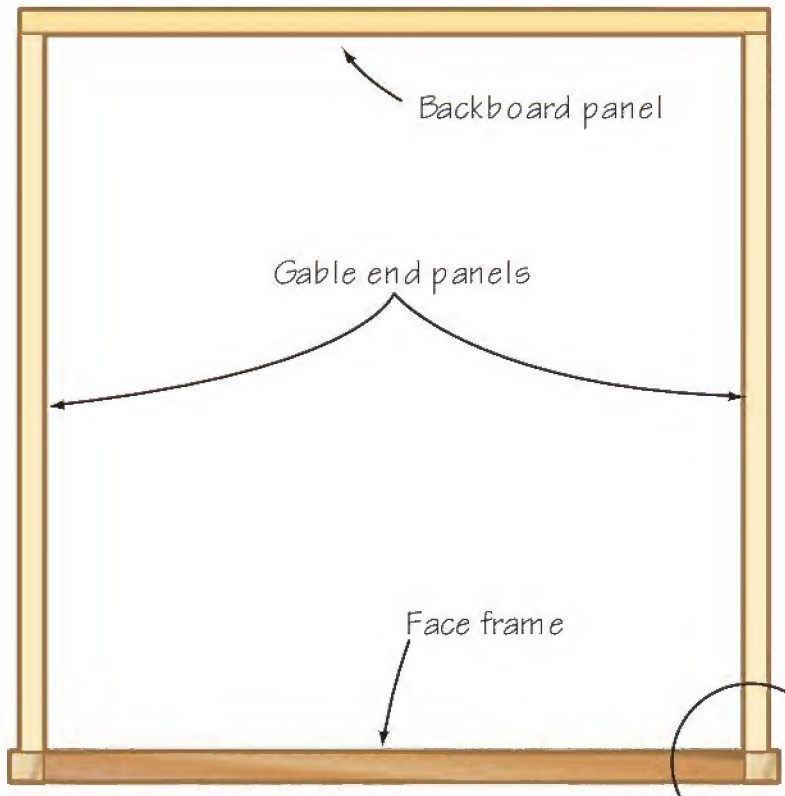
cabinet anatomy



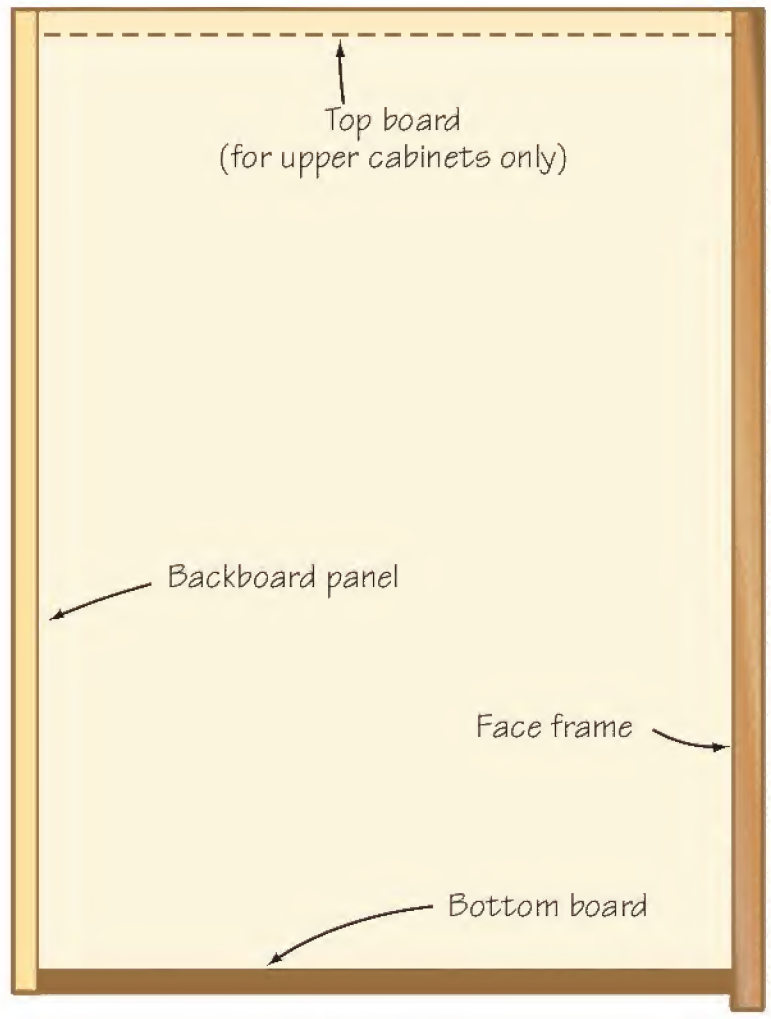
It's been said many times that a cabinet is simply a box. The analogy is quite true, and the parts associated with a cabinet follow that concept...to a point. In general, a cabinet has two sides, a top, a bottom and either doors or drawers at the front. If the cabinet is a base cabinet with a separate counter top, the "top" of the cabinet may be mounting strips covering only part of the opening. If it's a base cabinet, there is usually a kickboard, or kick plate set back slightly behind the cabinet bottom. If the cabinet has a face frame, then rails (the horizontal pieces) and stiles (the vertical pieces) are also part of the anatomy.

A hardwood face frame is constructed and installed to replace the European method of taping the PB edges on a frameless-style carcass. This face frame gives the cabinet a North American appearance. Face-frame components consist of vertical members called stiles and horizontal members called rails.

NOTES:
1. Base cabinets require adjustable legs.
2. Base cabinets do not require top board.

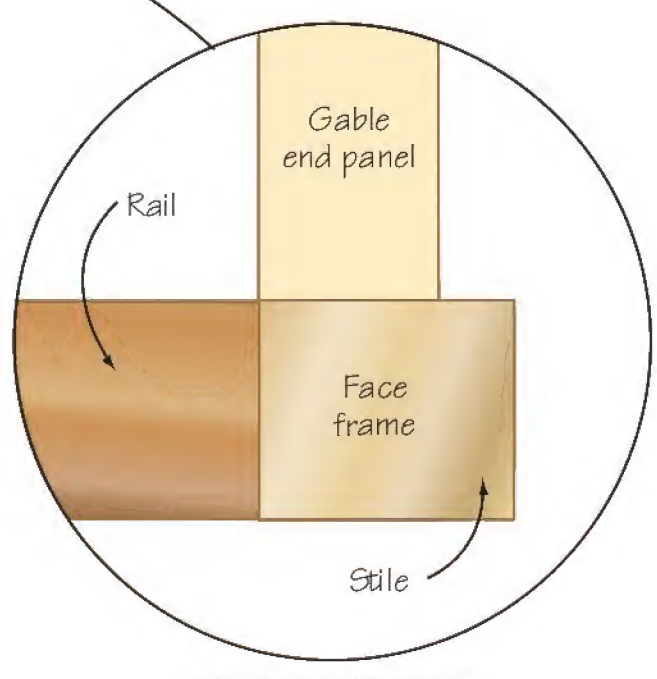


TOP PLAN VIEW



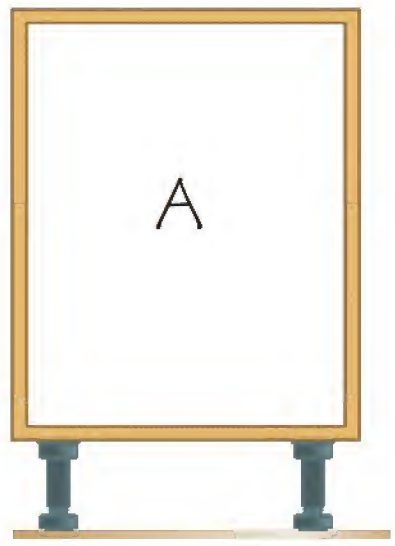
LEFT-SIDE VIEW

This illustration details the cabinet parts. An upper cabinet is shown, however the part names for base cabinets are identical. Bases differ from uppers because they do not require a top board and they have adjustable cabinet legs installed.



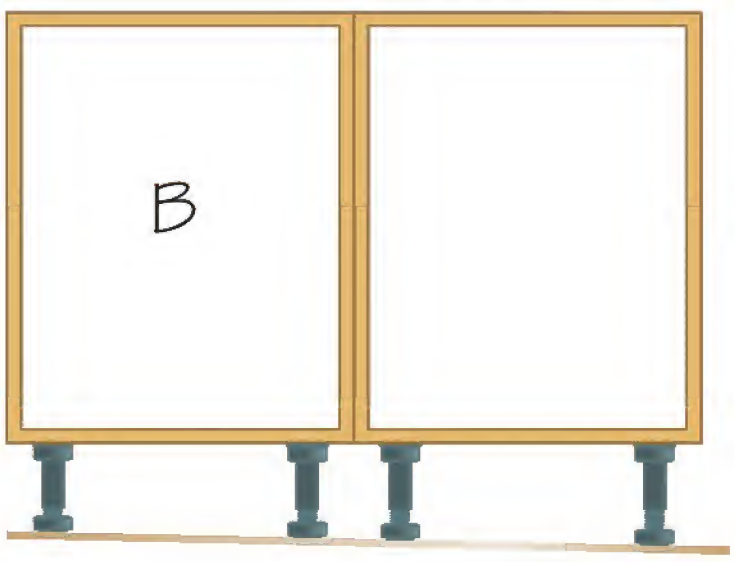
FACE-FRAME DETAIL

BENEFITS OF USING ADJUSTABLE LEG ASSEMBLIES



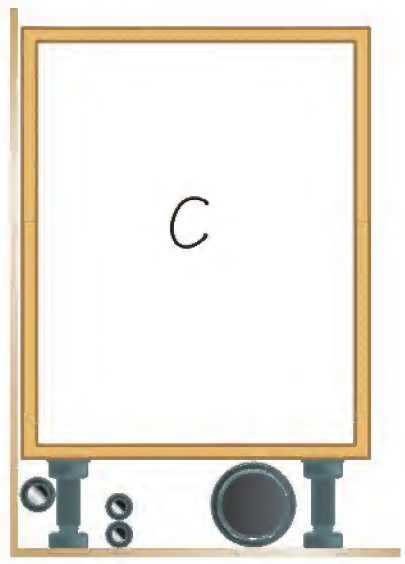
A

- Yields more pieces of wood per panel
- Reduces the number of cuts
- Reduces wastage of material
- Reduces cutting time
- Reduces inventory (right side, left side)
- Allows for more regular cutting
- Results in lower cabinet height, facilitating easier installation and transportation



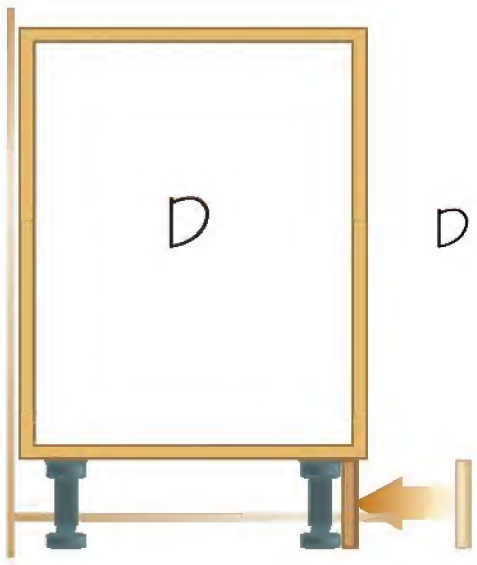
B

- Ensures that cabinets are always perfectly aligned
- Eliminates the use of shims to obtain perfect leveling
- Minimizes physical effort



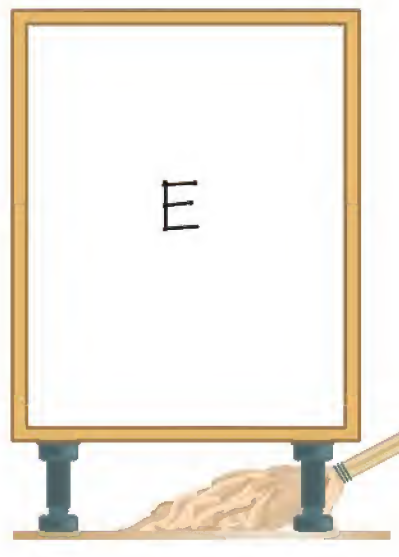
C

- Assures easy passage for water lines, electrical wiring and ventilation systems
- Allows for uncluttered cabinet interiors



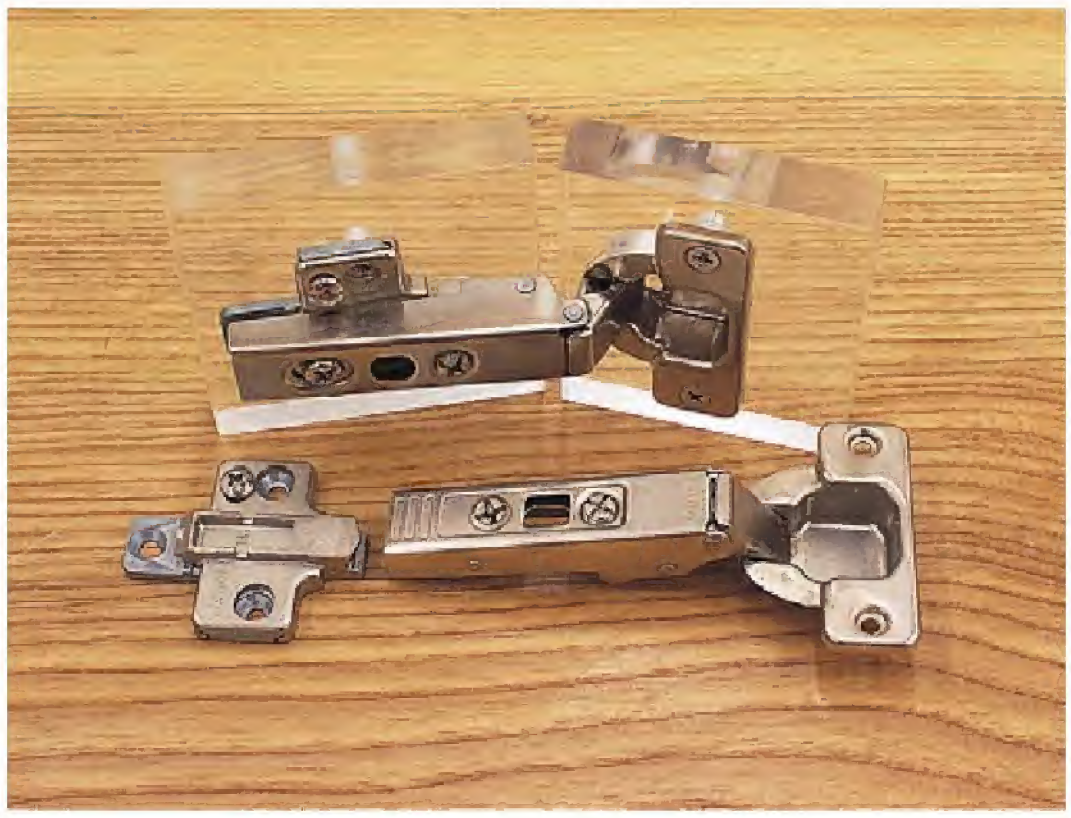
D

- Makes the toe-kick plate independent and easier to fit and install
- Eliminates notches for the toe-kick plates



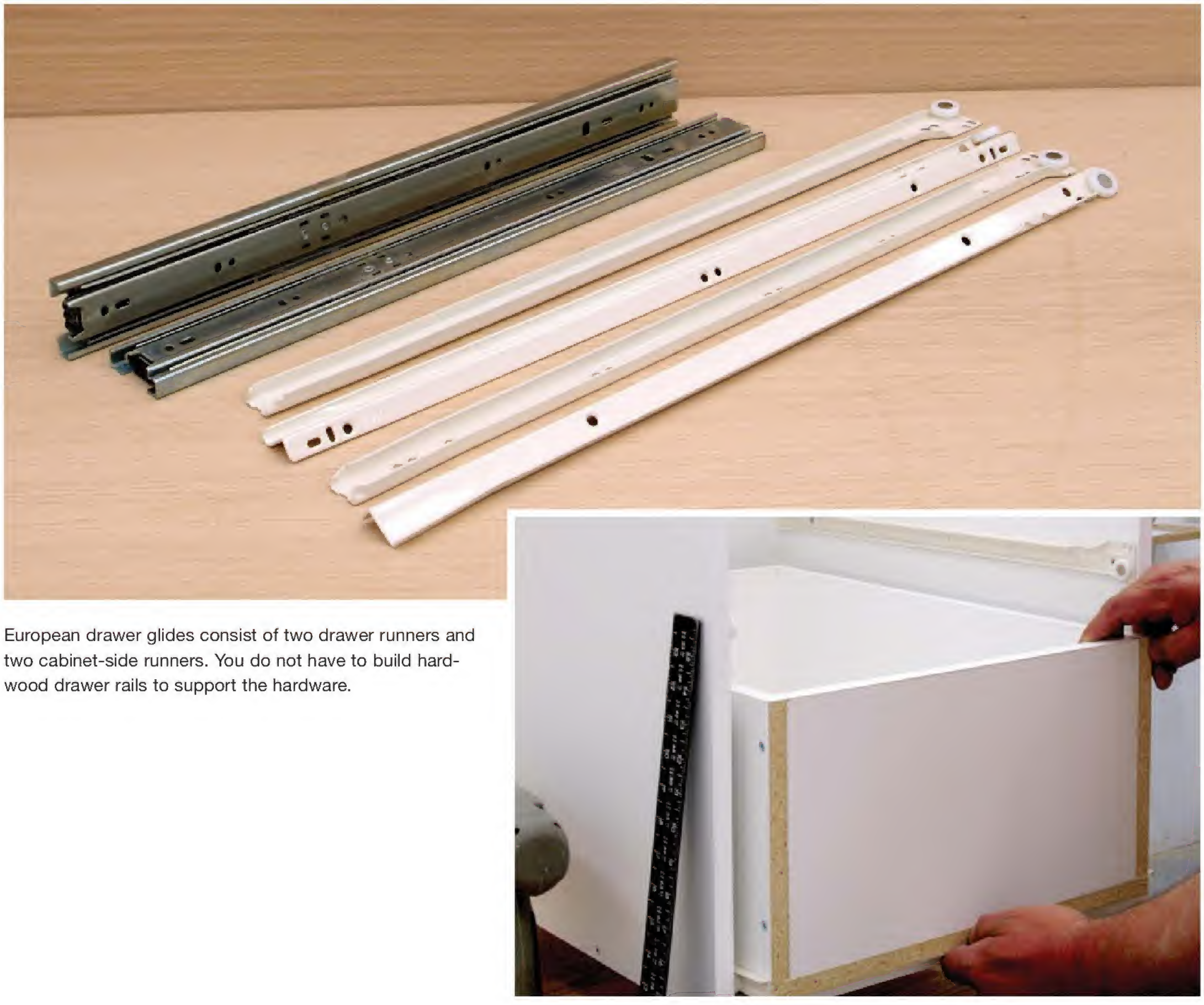
E

- Permits easy access under the cabinets for the user, making for easy upkeep and repairs
- Allows for extra storage space



European door hinges can be adjusted in three directions. The design of this hinge allows for accurate placement of the cabinet doors. Hinges are classified by degrees of opening. A 90° hinge will allow the door to swing fully open at a right angle to the face frame. There are also 100°- to 180°-opening hinges. Corner base cabinets with a lazy Susan installed require a wider degree of door opening to provide easy access to the cabinet.

Cabinet legs come in many styles. One common model is attached to the cabinet base with four 5/8" screws through holes in the leg flange. The kick plate simply clips onto the leg with an assembly called a plinth clip.



European drawer glides consist of two drawer runners and two cabinet-side runners. You do not have to build hard-wood drawer rails to support the hardware.

material lists & cutting plans

CUTTING LIST FOR A 36" (914MM) CORNER BASE CABINET USING ¾" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	
A	2	sides	melamine pb	¾	(19)	22½	(572)	31	(787)	
B	1	bottom	melamine pb	¾	(19)	33¾	(857)	33¾	(857)	cut as illustrated
C	2	backs	melamine pb	¾	(19)	22¾	(578)	31	(787)	
D	1	back	melamine pb	¾	(19)	18	(457)	31	(787)	cut oversize, then sides are angle-cut at 45° to fit
E	2	stiles	hardwood	¾	(19)	1½	(38)	31¾	(806)	
F	2	rails	hardwood	¾	(19)	1½	(38)	11¼	(285)	
G	2	rails	hardwood	¾	(19)	1½	(38)	10½	(267)	
H	2	doors		¾	(19)	10	(254)	30½-high	(775)	stock can be wood-veneer pb or frame and panel hardwood

Whether you're building one cabinet for your bathroom, or 15 for your entire kitchen, the place to start is on paper. If it's multiple cabinets you are building, then you need to start with a floor plan. It's your information source and road map to completing the project successfully. Draw the plan to scale so that any potential problems can be discovered before you begin construction. You'll find this exercise is valuable and the time spent will be well worth your effort.

Design software programs are available on the market for those of you who are familiar with computers. These programs, (some free, some costing under $100), sometimes allow you to render a three-dimensional image of the proposed cabinetry on the screen. A few programs allow you to move around in the room, showing different perspectives of the cabinets.

However, the most important exercise is drawing a simple, scaled overhead floor plan like the example illustrated in the drawing on the following page.

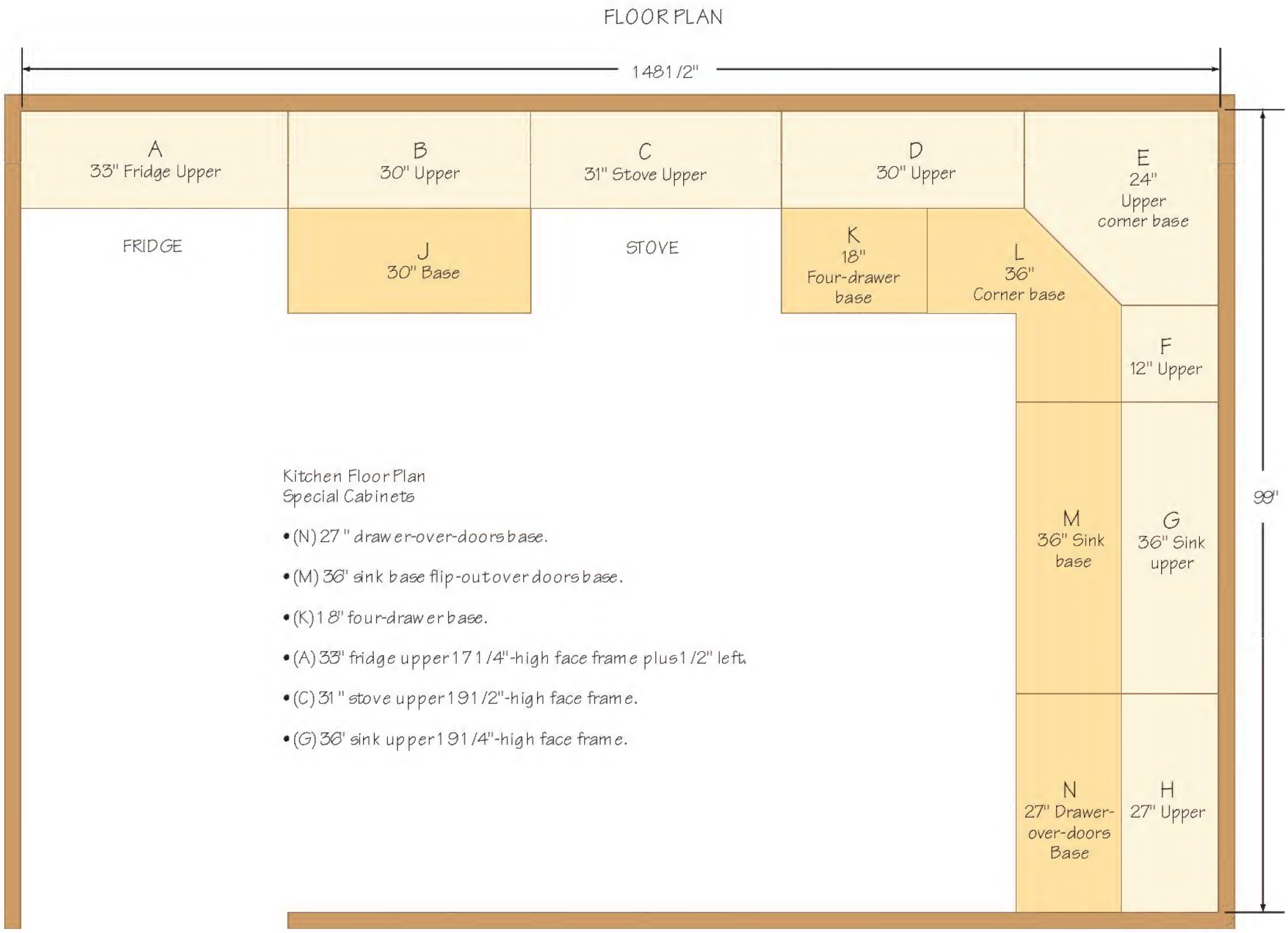
Accurately measure the room dimensions, locating all the doors, windows and any special features of the walls. You may have a plumbing run or heating duct pipe that has been boxed in with drywall that creates a bump-out on the wall. These special features have to be accounted for, as they may change your cabinet installation procedures. Use graph paper to scale the

cabinets on your plan, so you get an accurate representation of the size and location of each unit. Analyze the plan, checking work triangle distances, traffic patterns, as well as the opening direction of the cabinet doors, refrigerator and microwave.

The ideal floor plan is difficult to achieve given the dimensions of many kitchens. For example, the floor plan in the drawing below places the refrigerator at one end of the room and the sink on another wall at the other end of the room. The distance is greater than it should be for comfortable food preparation, but because of power requirements and the location of other appliances, we were forced to compromise. As well, a table cannot be placed in the center of the room, as it will seriously affect traffic patterns. In this case, a kitchen table was placed against the wall opposite the stove. It was the best alternative to many possible floor plans that were analyzed.

This floor plan is shown to illustrate that you sometimes have to work in existing rooms that do not allow us to follow all the accepted normal design practices. It's not an uncommon situation, and I'm sure some of you will be faced with design challenges such as this.

One alternative would be a complete relocation of existing services. This project was a kitchen in an old three-level apartment building, and budget constraints and tenants did not allow changes to existing services.



Creating a Materials List

Once the floor plan is finalized, create a materials cutting list. This list will allow you to calculate how much material to order, and provide you with a system to number each cut piece. An average kitchen requires one hundred or more PB pieces, so this list is invaluable during the assembly phase of your project.

The following table details a portion of the ⅝" white melamine particleboard material cutting sizes that are required for the kitchen shown in the floor plan. Only two cabinets are shown to illustrate the process; in the full list, however, all the cabinets should be listed and part numbers assigned to each piece. It's a good way to identify each panel for your project; otherwise, you'll be measuring hundreds of times, trying to locate the proper panels for each cabinet.

If your cabinets are wood face-frame style, your cutting list should include those parts. Once again, these cutting lists may seem time-consuming, but they'll save you many hours and greatly lessen the frustration of trying to manage hundreds of panels and solid-wood parts. Preparing the cutting lists should take you one to two hours, depending on the complexity of the kitchen design. However, it will probably be the most effective two hours that you'll spend building the kitchen. These lists are critical, as they define the sizes of the finished pieces for the carcasses, face frames, doors and drawer faces.

I transfer the carcass cutting list sizes to a diagram of 4' × 8' sheet material. Sheets are drawn with the reference numbers relating to each individual piece. Once completed, this layout provides information on the number of pieces of 4' × 8' material you will require. This process also minimizes the waste that occurs because you can move pieces around to get the best results prior to cutting. The quantity of sheet goods required is also necessary when calculating your material cost.

Preparing the cutting lists and sheet layout diagrams reduces the amount of time required to cut the cabinet parts to size. Cutting the 4' × 8' material can be a tiring and time consuming process without proper planning.

MELAMINE PARTICLEBOARD CUTTING LIST FOR ⅝" (16MM) THICK PB
INCHES (MILLIMETERS)

CABINET STYLE AND IDENTIFIER	CUT SIZE REQUIRED		PANEL REFERENCE NUMBER
A - 33" (838) fridge upper **(17¼" (438) high face *plus ½" (6) left	2 sides @ 10⅝ × 16½	(270 × 419)	1, 2
	1 bottom @ 10⅝ × 31 1/16	(270 × 789)	3
	1 top @ 10⅝ × 31 1/16	(270 × 789)	4
	1 back @ 32 7/16 × 16½	(824 × 419)	5
	1 shelf @ 10⅝ × 31	(270 × 787)	6
B - 30" standard face-frame upper	2 sides @ 10⅝ × 31	(270 × 787)	7, 8
	1 bottom @ 10⅝ × 28 1/16	(270 × 713)	9
	1 top @ 10⅝ × 28 1/16	(270 × 713)	10
	1 back @ 29 7/16 × 31	(748 × 787)	11
	2 shelves @ 10⅝ × 28	(270 × 711)	12, 13

*The "½" (6) left" reference means the left-side stile on this face-frame cabinet is ½" (6mm) wider than normal. This cabinet needs to be scribed to a wall that isn't plumb or smooth. The cabinet is considered to be a 33"-wide (838mm) reduced-height upper with a ½" (6mm) scribe left. The cabinet panel sizes don't change, as they are considered to be for a 33"-wide (838mm) cabinet; only the face-frame stile width changes.

**Notice that the face-frame height is ¾" (19mm) longer than the cabinet side. That rule applies to all face-frame cabinets.

¾" (19MM) THICK WOOD FACE FRAME CUTTING LIST
INCHES (MILLIMETERS)

CABINET STYLE AND IDENTIFIER	CUT SIZE REQUIRED		FRAME PART REFERENCE NUMBER
A - 33" (838) fridge upper (17¼" (438) high face frame) plus ½" (6) left	1 stile left @ 1½ × 17¼	(38 × 438)	1
	1 stile right @ 1 × 17¼	(25 × 438)	2
	2 rails @ 1½ × 31	(38 × 787)	3, 4
B - 30" (762) standard upper	2 stiles @ 1 × 31¾	(25 × 806)	5, 6
	2 rails @ 1½ × 28	(38 × 711)	7, 8

Wood face-frame or frameless cabinets also need a list of door and drawer sizes. You can create a parts list off this one if you plan to build your own drawers. If you are going to purchase doors, this list will be required by the supplier.

CABINET DOOR AND DRAWER FACE LIST
INCHES (MILLIMETERS)

CABINET STYLE AND IDENTIFIER	DOOR AND/OR DRAWER SIZE	QUANTITY
A - 33" (838) fridge upper (17¼" (438) high face frame) plus ½" (6) left	16-wide × 16-high door (406-wide × 406-high door)	2
B - 30" (787) standard upper	14½-wide × 30½-high door (369-wide × 775-high door)	2

Creating a Hardware List

The hardware requirements should also be calculated during this planning and layout phase. It doesn't have to be precise to the last screw required, but it should be a fairly accurate representation of the hardware needed. Material ordering and cost can be calculated based on this list. At right is a typical hardware list, based on the example design.

HARDWARE REQUIREMENTS

ITEM DESCRIPTION	QUANTITY
2" (51mm) particleboard screws	500
5/8" (16mm) hinge & angle clip screws	200
cabinet legs	30
plinth clips for toe kickboards	12
countertop angle brackets	25
2" (51mm) spiral finishing nails	100
adjustable shelf pins	60
100° full-overlay hinge assemblies	38
170° full-overlay hinge assemblies	4
double door hinge assemblies for corner base cabinet	2
18"-dia. (457mm-dia.) full-round lazy Susan	1
32"-dia. (813mm-dia.) pie-cut lazy Susan	1
door and drawer handles	27
door bumpers	50
22" (559mm) European drawer glides	5
cut-to-fit cutlery tray for cabinet K	1
5/8" (16mm) plastic cap moulding for shelves	40 feet (3.6m)
door-mounted towel rack for base M	1

Countertop Requirements

The countertop size should be calculated at this time. For our sample kitchen we will need a 30¾" run for cabinet J so we'll have ⅜" overhang on each side. Both sides should have a ¼" veneer panel (no moulding is needed) beside the stove and fridge. The other countertop section required will be a right-angle joined section. The left-side run will be 54⅜" long (this dimension includes the ⅜" overhang on the left side of cabinet K), and the right leg will be 99" long with an unfinished end.

If you are building a custom wood-edged countertop as detailed on page 113, you will have to order the PB, 1×2 hardwood edge, 1×3 wood for the backsplash and laminate. If it's to be a standard roll countertop from a local supplier, send your order in, as there can be a delay if the chosen design is not locally stocked. This issue of stock countertop designs should be discussed with your supplier to avoid delays, as some designs can take four to six weeks to arrive from the manufacturer.

Additional Material Requirements

Material required for finishing should also be calculated at this stage, including: ¼" veneer-covered plywood for finishing the exposed sides of cabinet J, the left side of cabinet K, and half the exposed sides of cabinets B, D, F and H (this veneer plywood is also required to cover the underside of the upper cabinets); 1×4 hardwood for the kickboards; and top moulding for the upper cabinets.

Creating a Project File

I create a working file for each project. In it I include my notes on the various designs and changes, the final layout, my cutting lists, order lists and any other information relating to this project. As the project proceeds I will add information on ordering, the hardware style numbers and final comments after the project is completed.

I find the file system to be one of my most valuable tools. I can refer to the project at any time and use the information in the future. You may run into a situation where you need an extra door handle, or a replacement door, or you may want to add another section two or three years down the road; it's a real plus to have all the information on file. If you don't have a great memory, the project file is an invaluable tool.

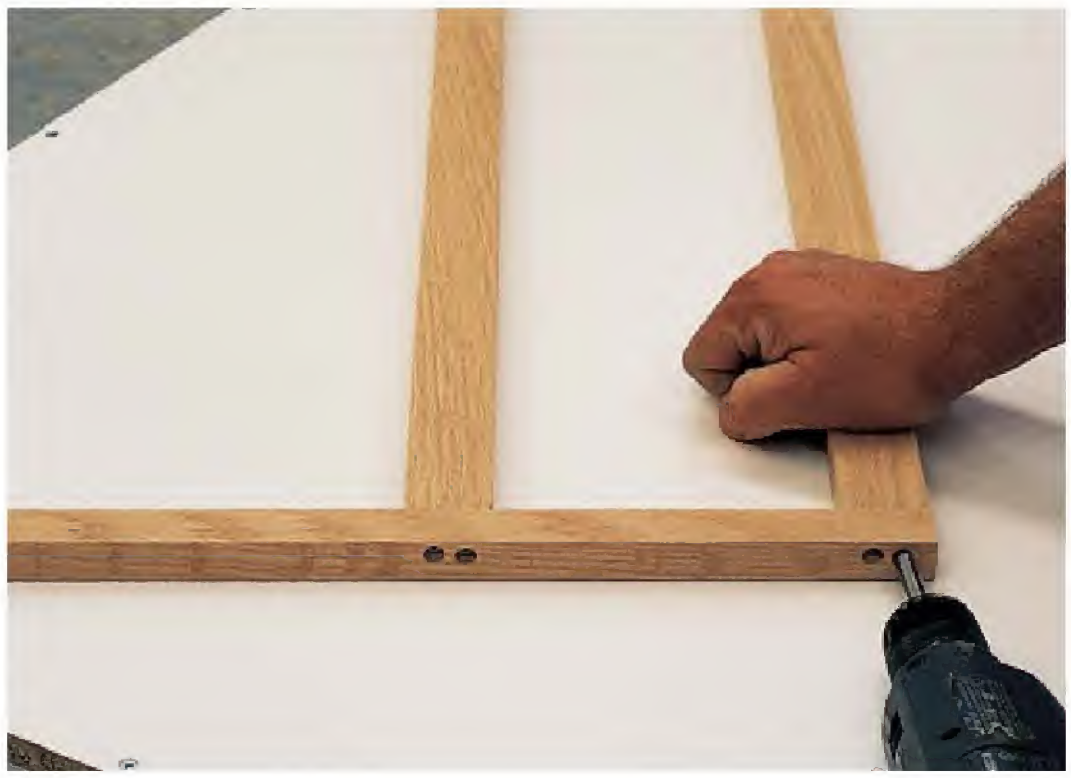
Project Planning

I lay out all my needs on the cutting lists, order the materials, get firm delivery commitments from any subcontractors such as my countertop supplier or cabinet door supplier, and calculate shop time needed to build the cabinets. I can then realistically plan when to tear out the old cabinets and install the new kitchen. This gives you the opportunity to arrange for the other required services, such as new flooring installation, new appliance delivery, the plumber or possibly an electrician. You can also start making plans for kitchen downtime and all the lifestyle changes for your family.

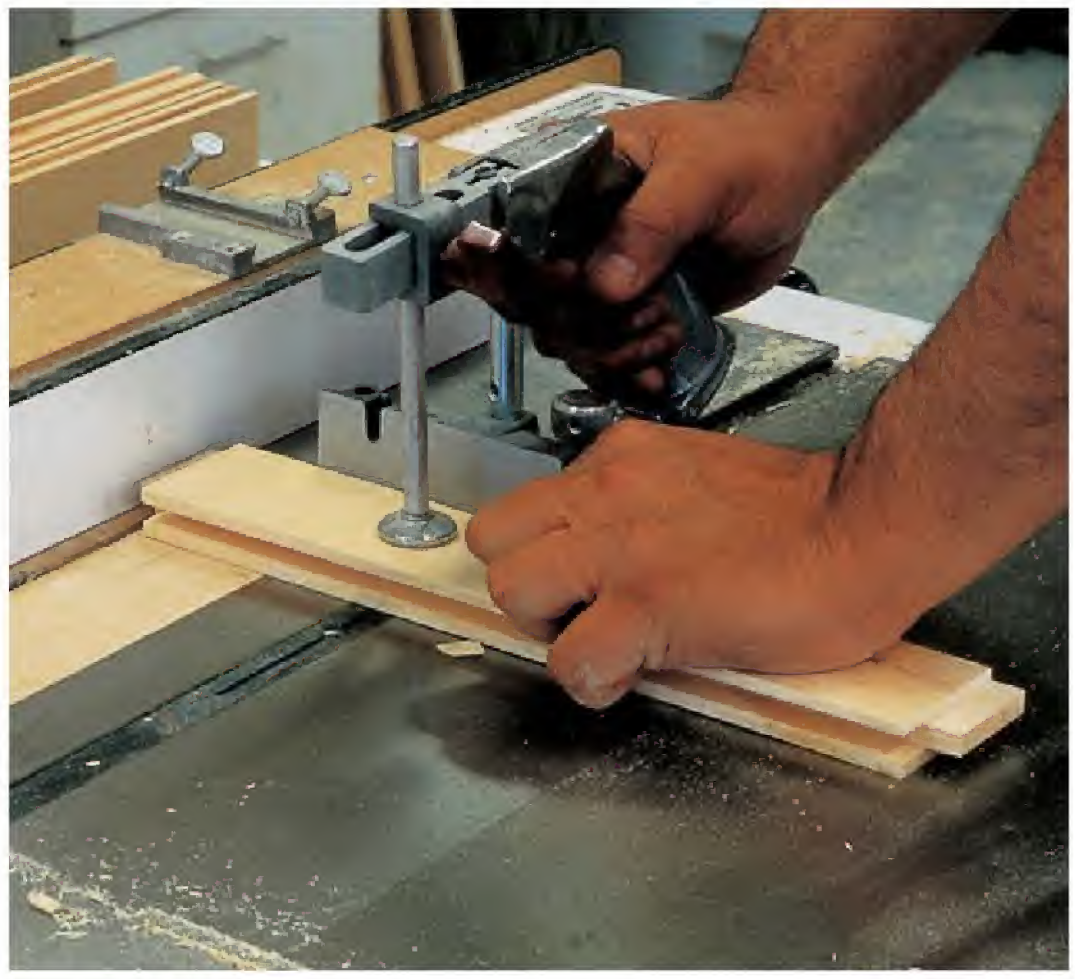
The planning stage is critical. A project can turn into a real nightmare if you make mistakes at this point in the process. I'm not suggesting that this is a difficult process; it's actually very simple, but unfortunately many people do not pay enough attention to this stage and get into serious trouble. Analyze all the required steps, detail your material needs, estimate realistic time frames based on the data, and keep the other people who you will have to depend on informed about your progress.

assembly procedures

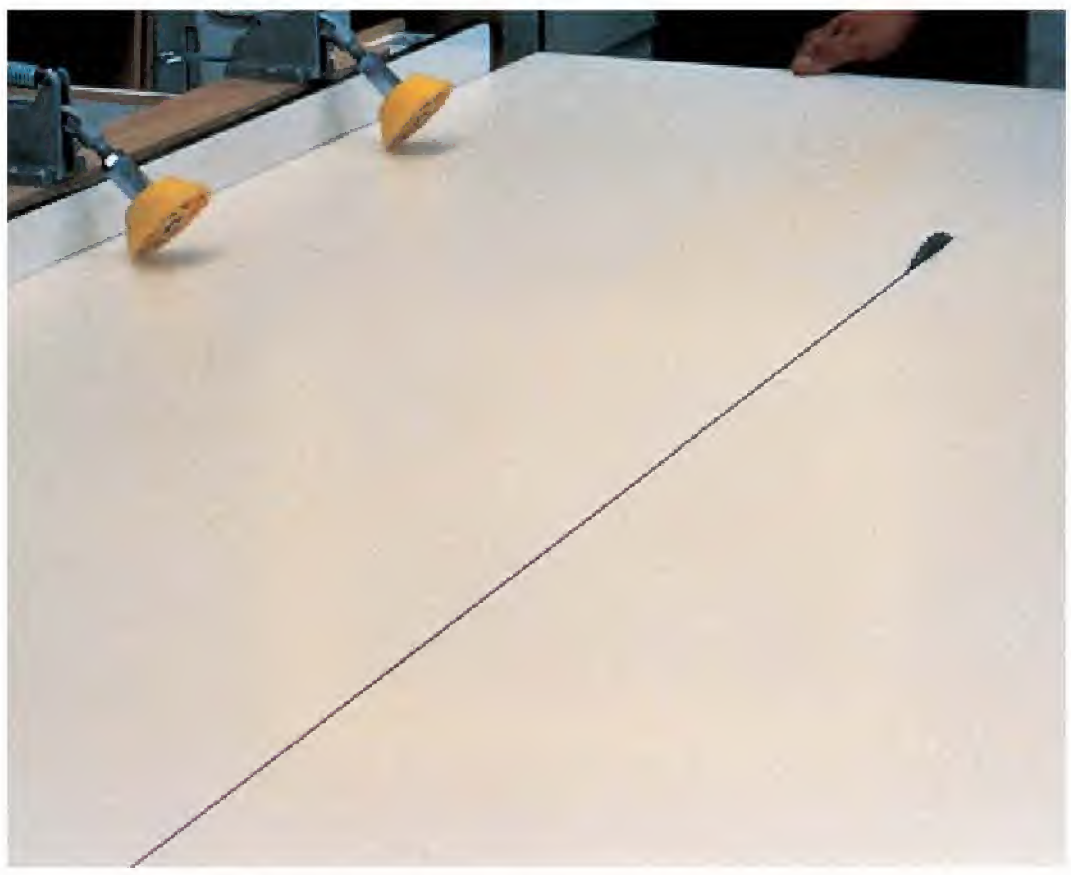
Most woodworking shops, whether professional or hobby, have a similar set of tools and machinery that include a table saw, drill press, clamps, drills, etc. Not every shop will have a table saw with a sliding crosscut table as shown, above, but the cross-cutting task shown could also be completed with a circular saw. The steps following are those used to build a simple, but very functional and versatile cabinets. Please adapt the basic steps to the machinery and tools that are at your disposal.



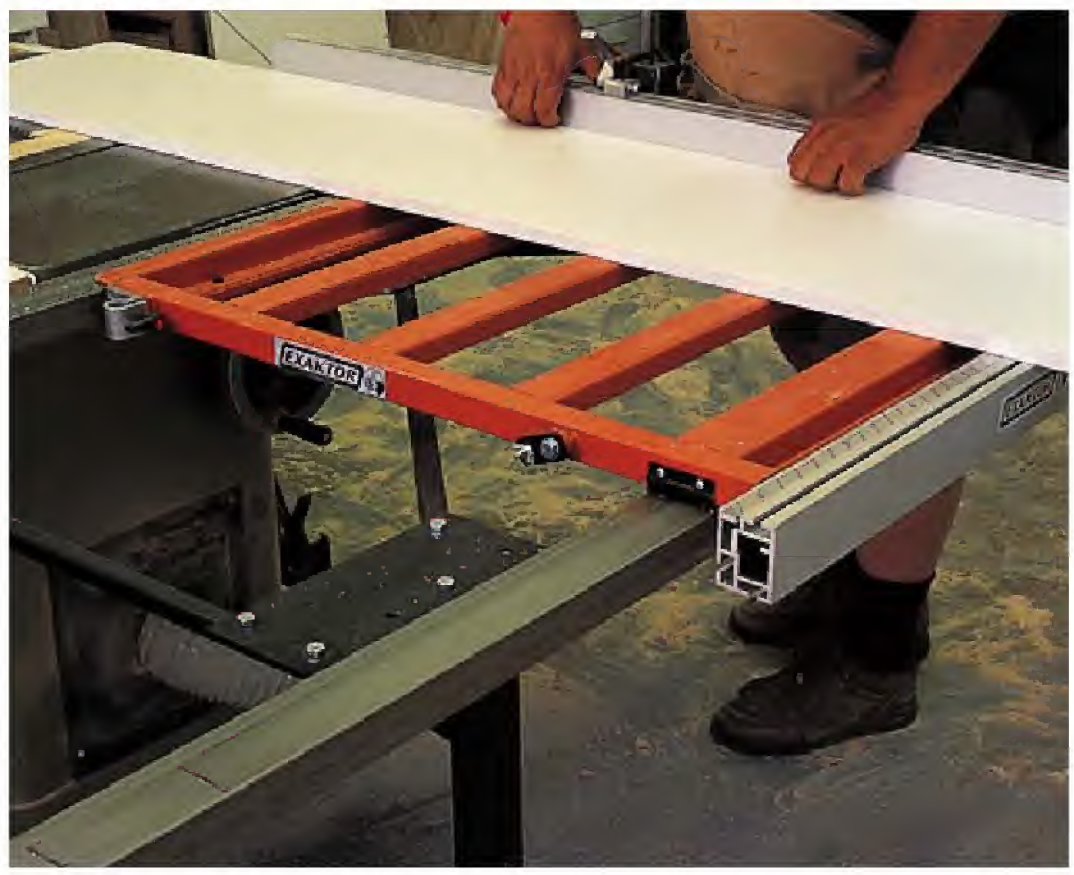
1 If you are building a face-frame cabinet, cut to size and assemble the hardwood face frames so they can be sanded and finished. For this particular kitchen project I finished the face frames with three coats of clear satin polyurethane. Do not finish the back side of the face frame, as it will be glued to the carcass edge. You will be able to start assembling the carcasses while finishing the face frames and doors. You can also calculate how many, as well as the sizes of, end panels and undercabinet ¼" veneer plywood panels required. They can be cut and finished along with the face frames and doors.



2 Assemble and finish doors and drawer faces with the face frames while cutting and assembling the carcass. In the photo I'm cutting a cope-and-stick door frame on the table saw.

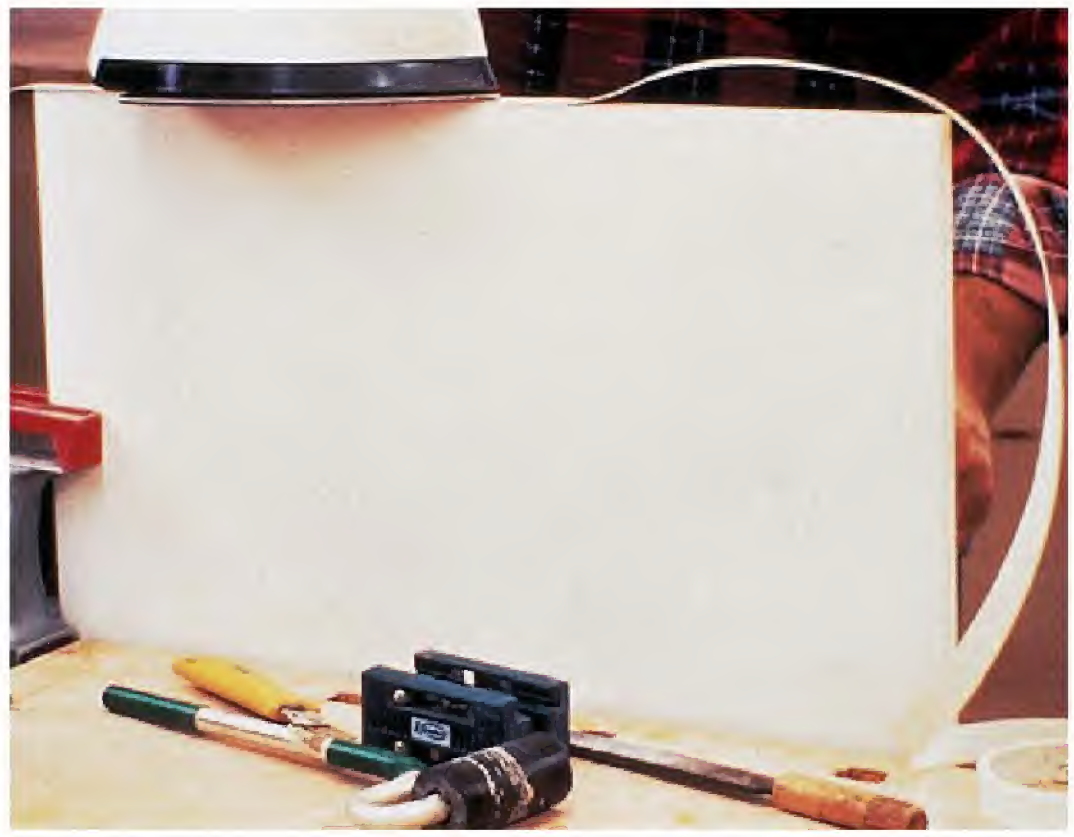


3 Rip 4' × 8' sheets of sheet material to size with the aid of the cutting lists and layout sheets. Melamine-coated particleboard edges chip easily, so take special precautions. Primarily, equip your table saw with a carbide-tipped melamine PB blade. Melamine PB has a tendency to chip on one side more than the other. I orient the boards during cutting so the good side is always maintained. The only boards that will be exposed on both sides are the shelf boards and the drawer carcass sides. Chipping can be minimized on these boards by double-cutting: Set the saw blade at half the thickness of the melamine PB and cut on one side, then flip the PB over to complete the cut on the other side.

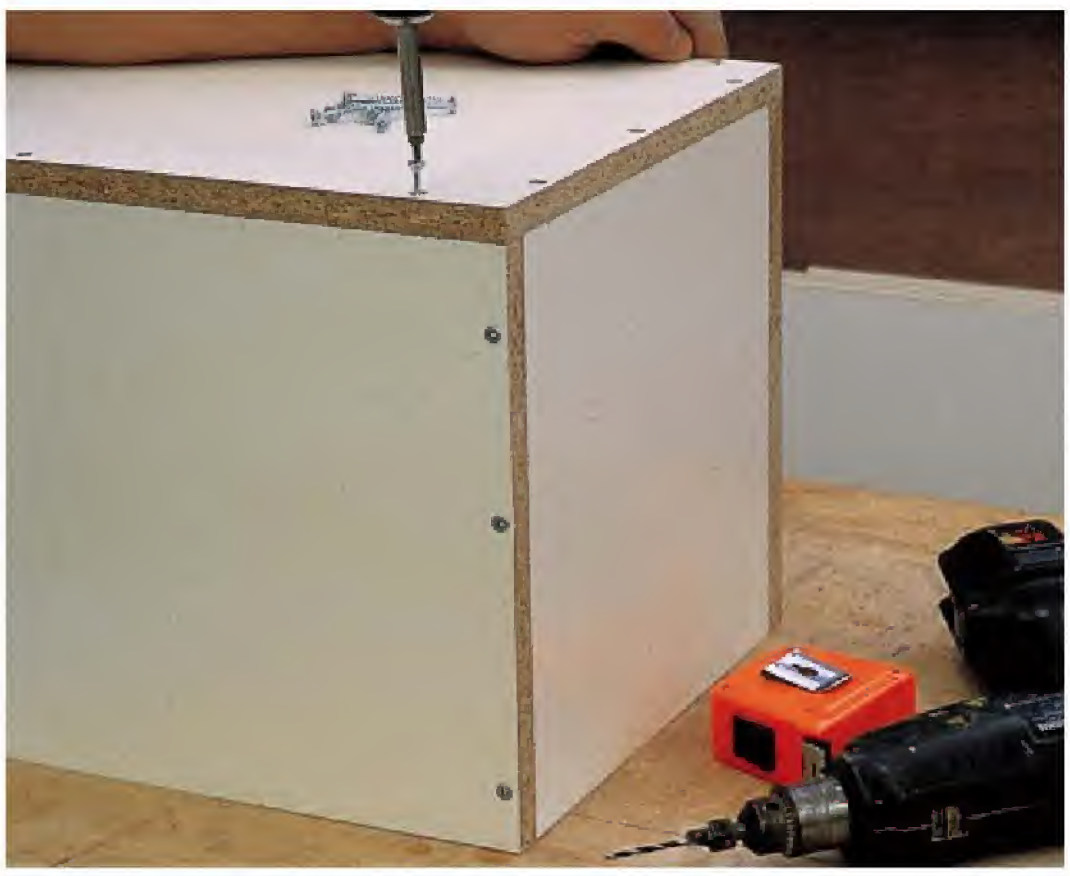


4 Following the ripping step, crosscut the boards on a radial-arm or table saw. If the boards are extra wide, such as in the case of the base cabinet boards, I use a sliding table attachment on my table saw, or you can just as easily use a circular saw and clamped straightedge. Since the saw chips on one side more than the other, always pay attention to the board's good side when you orient it. Mark each piece with its reference number.

5 Verify the board sizes, then begin the assembly of the cabinets. First, drill the upper cabinet sides for the adjustable shelf pins.



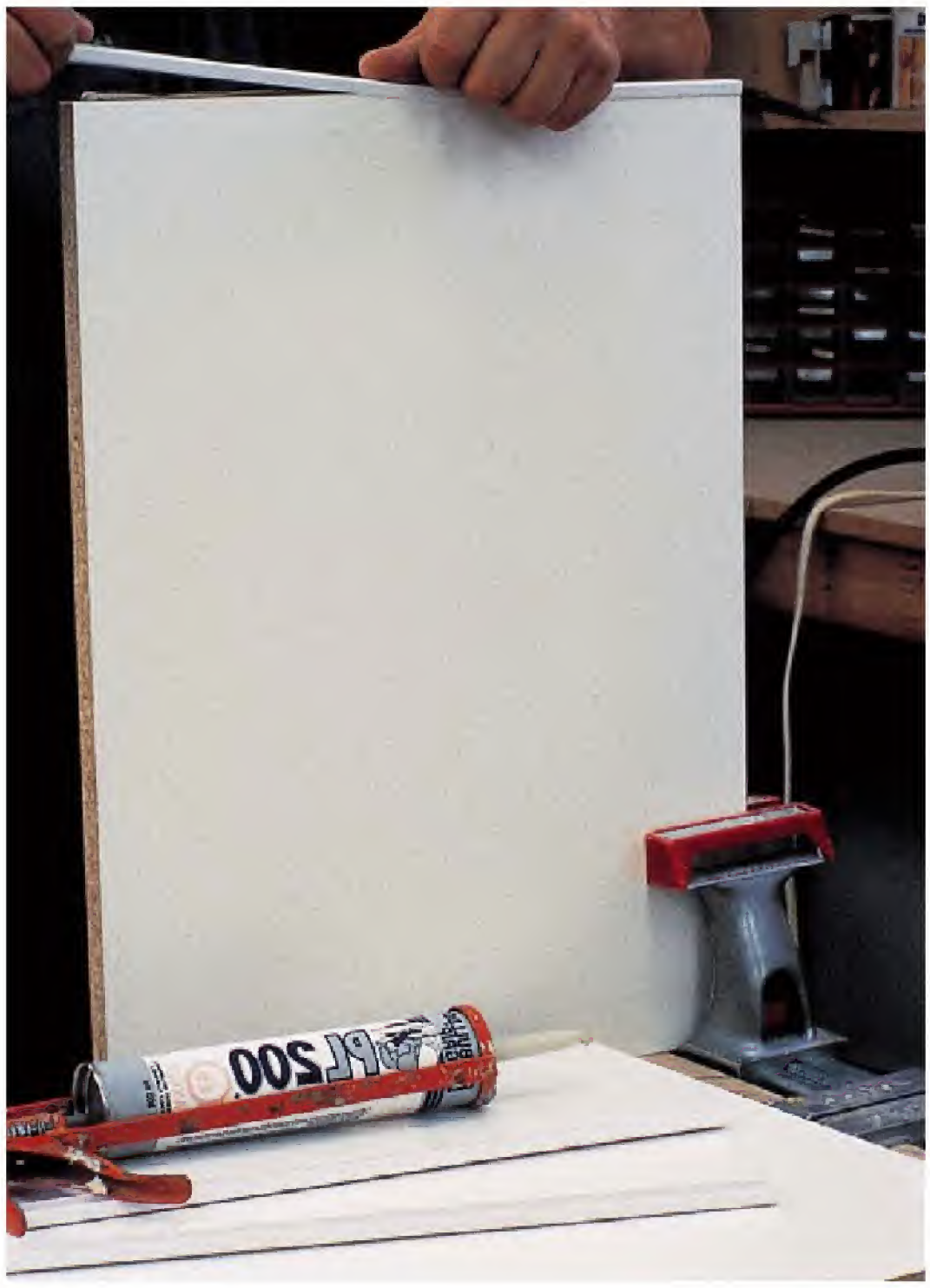
6 If you are building the frameless cabinet version, apply edge tape to all edges that will be visible after the cabinet is installed. Use wood veneer or white melamine edge tape to match the cabinet doors.



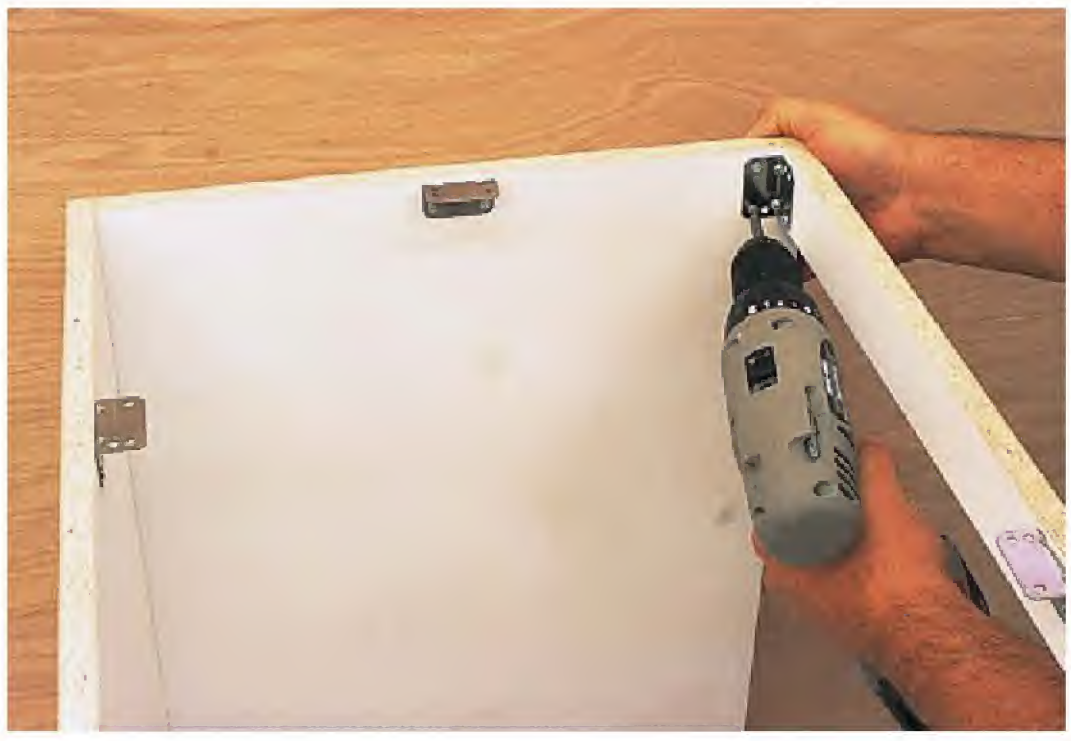
7 Now fasten the sides to the top and bottom boards with 2" particleboard screws. Install the back flush with the bottom and top board, as well as one side board.

When using the 2" PB screws, make certain to drill a ⅛" pilot hole through the board to be secured, and into the center of the edge of the second board. Use a marking gauge set at 5⁄16" for ⅝" material and ⅜" for ¾" stock as a guide for the drill bit. The screws should be tight; however, be careful they are not overtightened. I use a ⅛" drill bit in a carbide-tipped ⅜" countersink assembly to a depth that allows the screw head to be set flush with the surface of the PB.

8 Install the face frame on the cabinet, making sure of the orientation of any special face frames. For example, if cabinet A has a 1½" stile on the left side, designated on the drawing as + ½" L, the face frame must be installed with respect to that orientation. Set the face-frame outside top flush with the carcass outside top. The carcass edges should be hidden, and then glue and nail the face frame to the carcass as previously described.



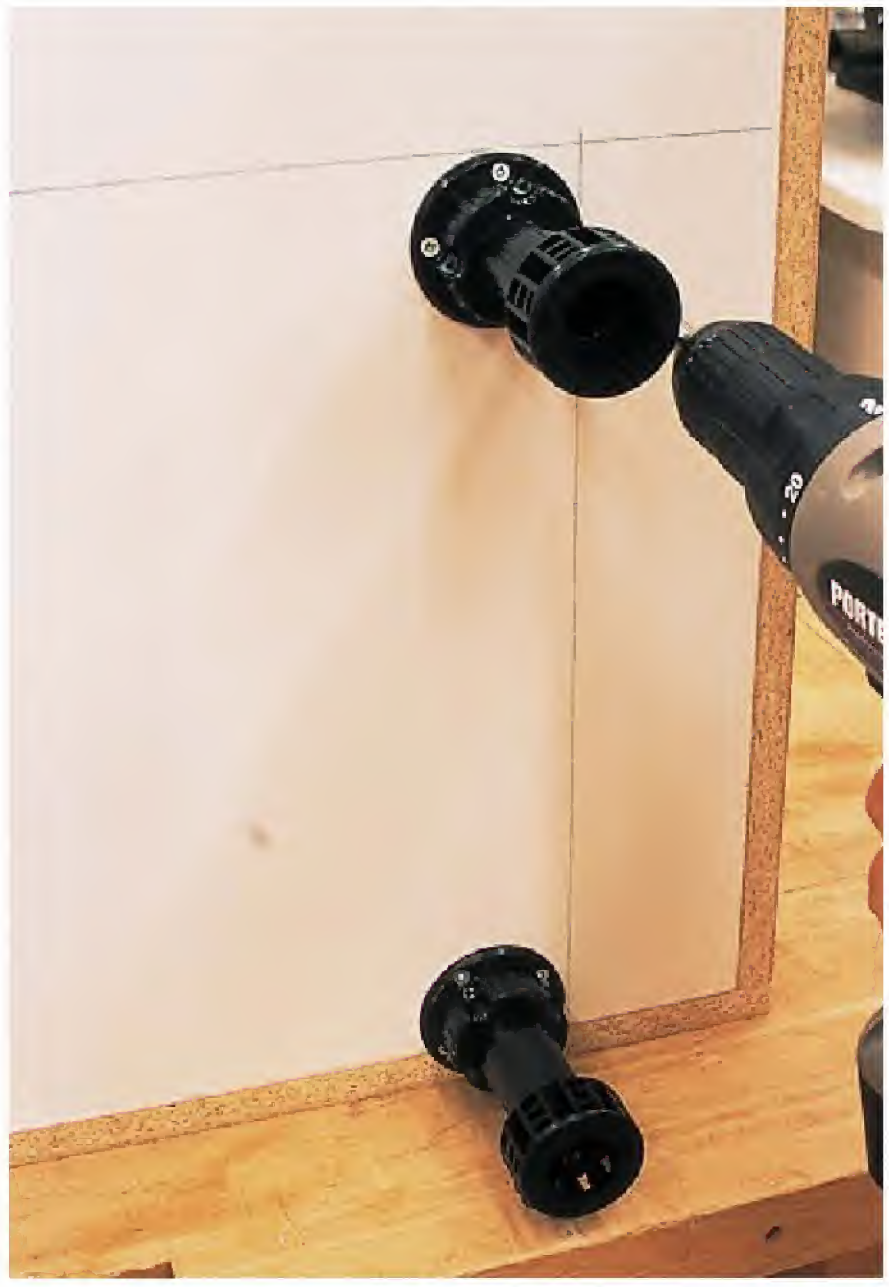
9 Cut the plastic cap moulding to fit the exposed edge of the shelves and secure with contact cement or a glue gun. The cap moulding fits tightly on the ⅝" melamine; however, I add a little glue to make sure it's held firmly in place.



11 Fasten the sides to the bottom board and install the backboard. When installing the backboard, verify that the inside dimension of the cabinet is correct at the top of the cabinet, between the two sides. The base cabinet does not require a top board; however, you must make sure the inside dimension, at the top, is correct, to guarantee a square and plumb cabinet.

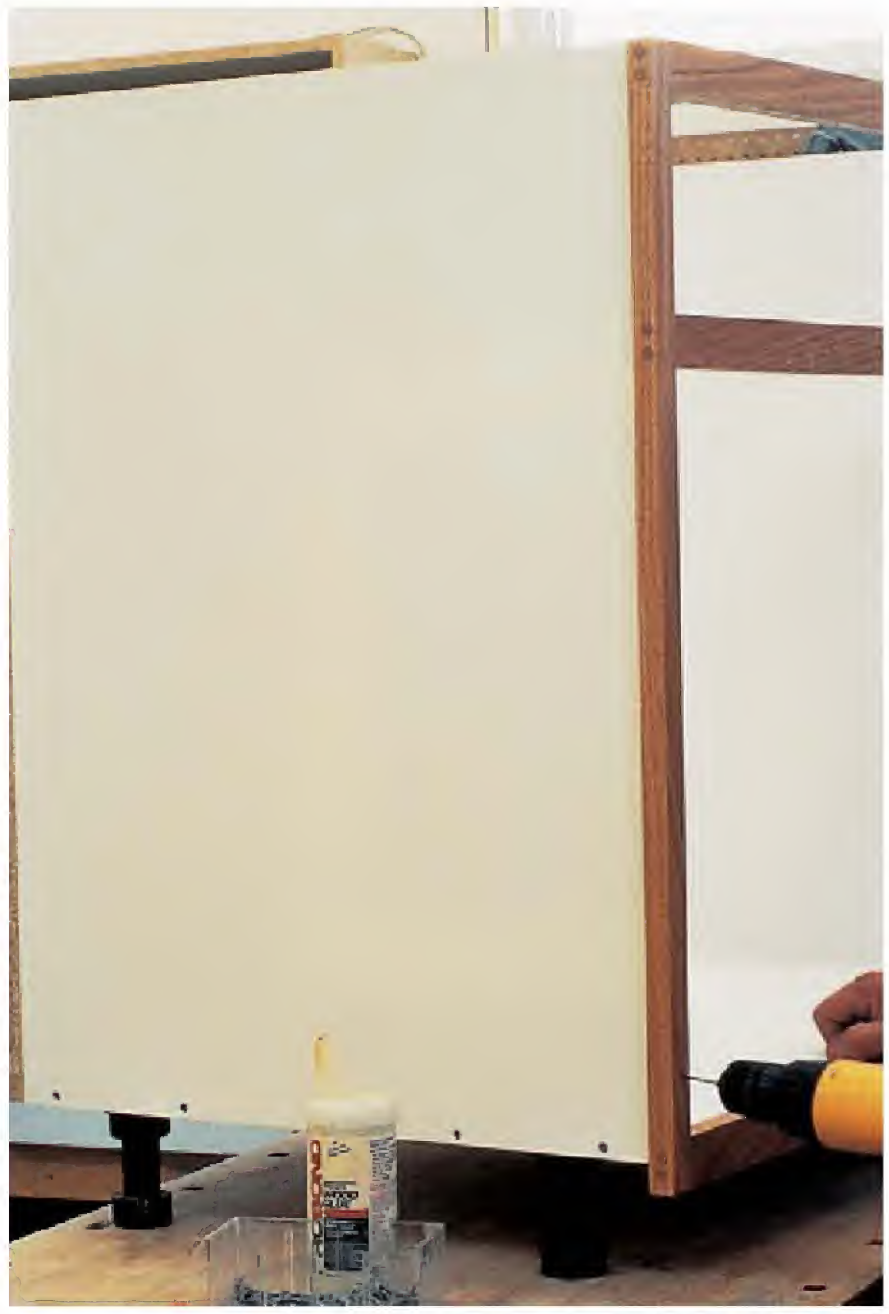
The top edge of the backboard must be aligned with the top edges of the sides so the countertop will sit flat on the cabinet. If you are building the frameless version, install the upper rail as described beginning on page90.

10 The first step in assembling the base cabinets is determining whether the cabinet will have a shelf or pullout installed. Drill holes for the shelf pins or fasten the wood cleats at the correct height, with 1¼" screws in pilot holes, through the outside of the cabinet side into the cleat.

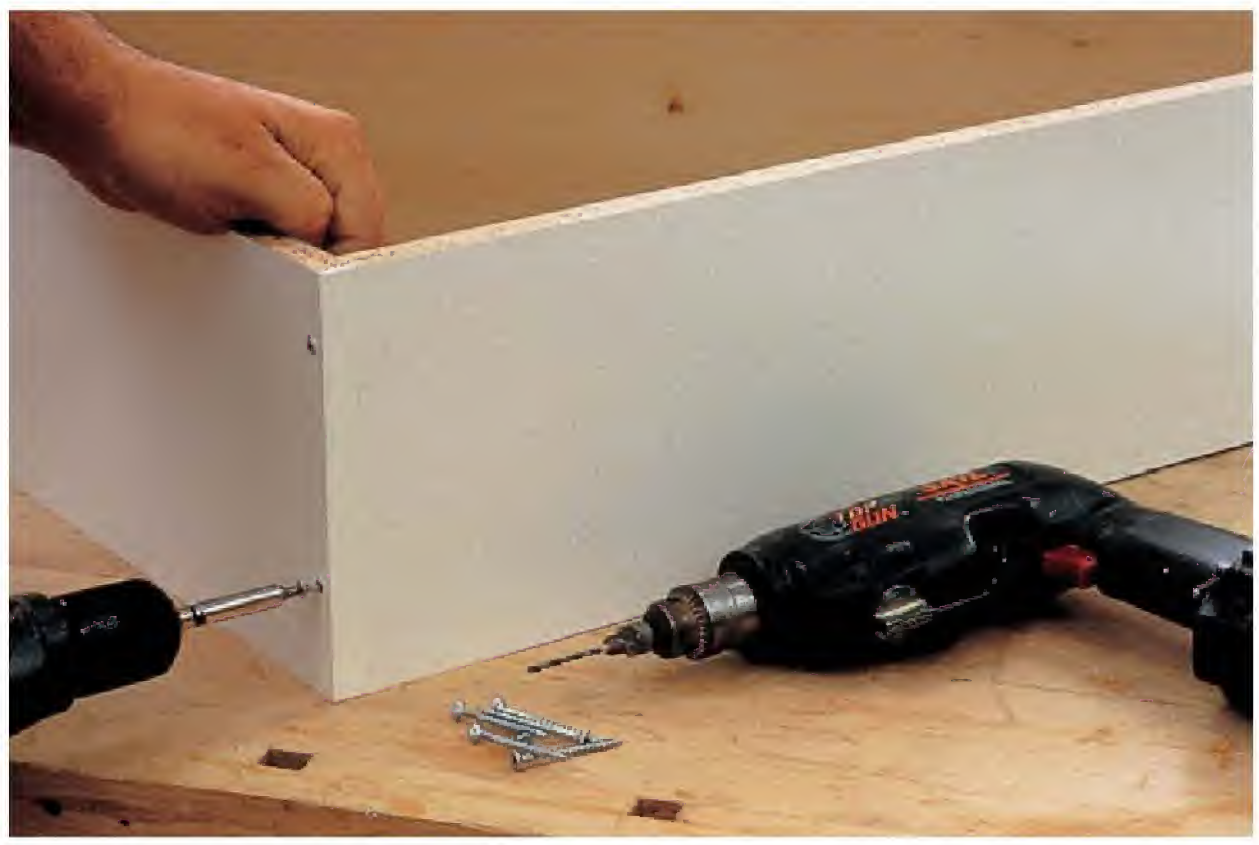


12 Install the cabinet legs on the base's bottom board. Install the legs so that they extend out from the bottom board by ⅝" to help support the sides. The exception is when the cabinet is an open-ended cabinet and the kickboard has to be recessed 3½" from the cabinet edge. Install the cabinet legs so that they are 3½" back from the face edge of the bottom board.

13 Install the countertop brackets with 5⁄8" screws. Use two brackets per panel on the back of the top rail, making sure they are flush with the top edges of the cabinet.



14 Install the face frame as previously described, noting any special orientation. Check that the top of the face frame is flush with the top of the sides and that the side overlaps are equal.



15 At this point, cut to size and apply ¼" plywood veneer to any cabinet side that will be visible. In the sample layout on page 21, veneer plywood will be attached with contact cement to the right and left side of cabinet J, the left side of cabinet K, the right and left side of cabinet B, the left side of cabinet D, the right side of cabinet F and the left side of cabinet H. On the upper cabinets, extend the veneer plywood below the side so that it will cover the end of the veneer plywood that will be applied to the underside of the upper cabinets. If you want to add wood doorstop moulding as a perimeter trim with standard 1"-wide stiles, you must use a thinner veneer. Apply a ⅛"-thick, or less, veneer to the cabinet sides so that you can use the ¼"-thick wood doorstop moulding.

16 Assemble the drawers and check the operation. Follow the drawer glide manufacturer's instructions with respect to clearances. Drawer side clearances are critical, so try to be as accurate as possible with your cutting and assembly procedures.

17 Drill the doors with a 35mm flat-bottom drill bit at 3" or 4" centers from the top and bottom of the door, and ⅛" in from the door edge. Pay particular attention to the door orientation if the door is designed with a top and bottom. Some door styles can be reversed while other designs, such as a cathedral style, must be installed one way. In some instances you have a right and left door. With single-door cabinets, the side you want the door to open on will determine where the holes are drilled. Mount the doors on the cabinets as previously described in chapter nine.

18 Drill the holes in the drawer faces for the handles you will be installing. Position the drawer faces on the cabinet with the drawer box in place. Drive screws through the handle holes, into the drawer box, to temporarily secure the face. Open the drawer, with face attached, and drive 1¼" screws through the back of the drawer box front board and into the back of the drawer face.

Remove the temporary screws and drill holes through the drawer box, using the drawer face holes as a guide, and then install the handles.

19 Leave the kickboards longer than required to allow custom fitting during installation. Test fit a sample section to verify correct leg placement and kickboard height.

20 Order your countertops if you plan to use the standard roll style for your kitchen project. If you're making the wood-edged top, follow the steps on page 113.

This completes the assembly process and the cabinets are ready to be installed. Compare the cabinets, noting any special features such as drawers, pullouts, wider stiles and door opening direction, with the layout to guarantee that all dimensions and requirements are correct.

wall-hung face-frame cabinets

The standard upper cabinet is the most basic cabinet in this building system. The sides or gable ends of the cabinet perform some important functions. Primarily, of course, they define the height of the cabinet box and give it strength. The sides also support the European hidden hinges and are drilled for the shelf support pins. Also, in this particular cabinet style, the face frame is nailed onto the side edges as well as the top and bottom board edges.

The bottom and top boards of the cabinet carcass form the box shape of the cabinet in conjunction with the sides. More importantly, the bottom and top boards define the interior width of the carcass. Be careful to cut these two boards to the proper dimensions.

Interior width is important because the doors, and the resulting door overlay, are calculated based on the inside dimension of the cabinet. This measurement determines combined door width, hinge style and individual door width.

Cabinet sides are cut to a length of 31", and the face-frame stiles are cut at 31¾". This is done so the face frame hangs ¾" below the carcass bottom. This feature gives a little flexibility when assembling cabinets and hides the edge of finish boards that will be applied under the cabinet.

Standard doors are 30½" high and mounted flush with the bottom of the face frame, leaving a 1¼" gap at the top of the cabinet for installation of edge moulding.

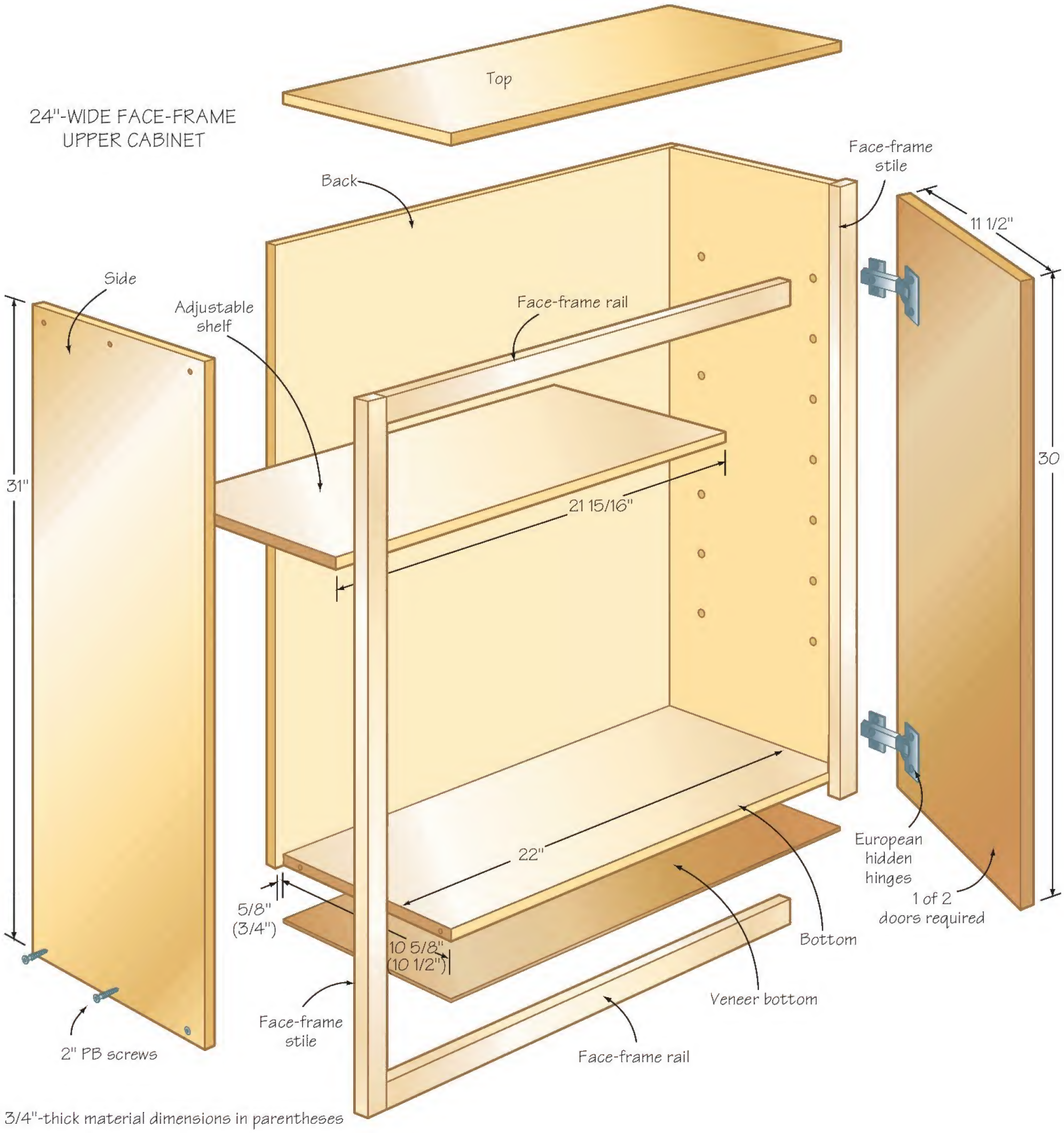
You'll want to remember a number of principles when creating a materials cutting list for your upper cabinets. The top and bottom boards are always 2" narrower than the cabinet exterior on this face-frame design. Cabinet width is measured at the widest point on the front of the cabinet. The stiles are each 1" wide, so if the cabinet we want to build is 30" wide, our bottom and top boards are 28" wide. This will make the inside face of each stile flush with the inside face of the cabinet sides, permitting us to use European hinges.

The stiles are ¾" longer than the cabinet sides, and the face-frame rails are the same width as the cabinet bottom and top boards. The backboard is equal to the cabinet's inside dimension plus the two thicknesses of side boards. For example, on a 30" cabinet using ⅝"-thick sheet material, our backboard must be 29¼" wide.

The standard upper cabinets usually have two shelves installed on adjustable pins. The shelves are cut 1/16" shorter than the bottom boards to make them easier to install and move. Door width, or one door on narrow cabinets, is determined by adding 1" to the interior width. If you need only one door, that's the final width. If two doors are needed, divide the interior-width-plus-1" formula by two. A 30" cabinet would need two 14½"-wide doors.

I want to be sure that the inside edges of my stiles fully cover the cabinet's side edges. It wouldn't look good if a bit of the carcass side's front edge was showing. To guarantee total coverage every time, the bottom and top boards, or the bottom board in the case of base cabinets, are cut 1/16" wider than required. As well, I always cut the backboards ⅛" more than needed as they can be accurately trimmed before installing them on the carcasses. The veneer bottom panel on upper cabinets is cut slightly narrower than the bottom so it can be installed after the cabinet is assembled.

A slight overhang of 1/32" on each stile inside the cabinet will not affect hinge installation. And I can always measure the assembled sides and bottom board's width and cut the backboard to the proper dimension.



Cabinet Sizes

Two cutting lists are shown. One is for construction of standard upper cabinets using ⅝"-thick material, and the other is for ¾"-thick material. They are sample widths; however, the components for any cabinet width can be calculated by following the construction principles.

CUTTING LIST FOR UPPER CABINETS USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX			FACE FRAME		
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	TOP & BOTTOM DEPTH × WIDTH	ONE BACK WIDTH × HEIGHT	TWO STILES WIDTH × HEIGHT	TWO RAILS HEIGHT × WIDTH	DOOR WIDTH 30 1/2" HIGH (775)
12 (305)	10 5/8 × 31 (270 × 787)	10 5/8 × 10 1/16 (270 × 256)	11 7/16 × 31 (290 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 10 (38 × 254)	1 @ 11 (279)
15 (381)	10 5/8 × 31 (270 × 787)	10 5/8 × 13 1/16 (270 × 332)	14 7/16 × 31 (367 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 13 (38 × 330)	1 @ 14 (356)
18 (457)	10 5/8 × 31 (270 × 787)	10 5/8 × 16 1/16 (270 × 408)	17 7/16 × 31 (443 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 16 (38 × 406)	1 @ 17 (432)
21 (533)	10 5/8 × 31 (270 × 787)	10 5/8 × 19 1/16 (270 × 485)	20 7/16 × 31 (519 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 19 (38 × 483)	2 @ 10 (254)
24 (610)	10 5/8 × 31 (270 × 787)	10 5/8 × 22 1/16 (270 × 561)	23 7/16 × 31 (595 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 22 (38 × 559)	2 @ 11 1/2 (292)
27 (686)	10 5/8 × 31 (270 × 787)	10 5/8 × 25 1/16 (270 × 637)	26 7/16 × 31 (671 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 25 (38 × 635)	2 @ 13 (330)
30 (762)	10 5/8 × 31 (270 × 787)	10 5/8 × 28 1/16 (270 × 713)	29 7/16 × 31 (748 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 28 (38 × 711)	2 @ 14 1/2 (369)
33 (838)	10 5/8 × 31 (270 × 787)	10 5/8 × 31 1/16 (270 × 789)	32 7/16 × 31 (824 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 31 (38 × 787)	2 @ 16 (406)
36 (914)	10 5/8 × 31 (270 × 787)	10 5/8 × 34 1/16 (270 × 866)	35 7/16 × 31 (900 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 34 (38 × 864)	2 @ 17 1/2 (445)

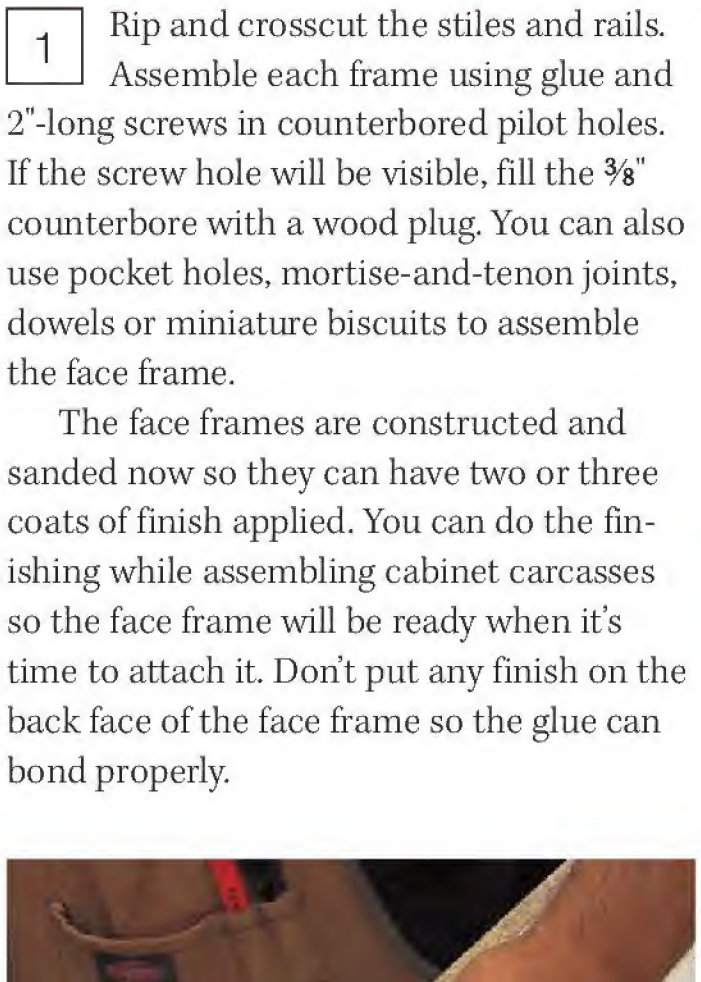
CUTTING LIST FOR UPPER CABINETS USING 3/4" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX			FACE FRAME		
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	TOP & BOTTOM DEPTH × WIDTH	ONE BACK WIDTH × HEIGHT	TWO STILES WIDTH × HEIGHT	TWO RAILS HEIGHT × WIDTH	DOOR WIDTH 30 1/2" HIGH (775)
12 (305)	10 1/2 × 31 (267 × 787)	10 1/2 × 10 1/16 (267 × 256)	11 11/16 × 31 (297 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 10 (38 × 254)	1 @ 11 (279)
15 (381)	10 1/2 × 31 (267 × 787)	10 1/2 × 13 1/16 (267 × 332)	14 11/16 × 31 (374 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 13 (38 × 330)	1 @ 14 (356)
18 (457)	10 1/2 x 31 (267 × 787)	10 1/2 × 16 1/16 (267 × 408)	17 11/16 × 31 (450 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 16 (38 × 406)	1 @ 17 (432)
21 (533)	10 1/2 × 31 (267 × 787)	10 1/2 × 19 1/16 (267 × 485)	20 11/16 × 31 (526 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 19 (38 × 483)	2 @ 10 (254)
24 (610)	10 1/2 × 31 (267 × 787)	10 1/2 × 22 1/16 (267 × 561)	23 11/16 × 31 (602 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 22 (38 × 559)	2 @ 11 1/2 (292)
27 (686)	10 1/2 × 31 (267 × 787)	10 1/2 × 25 1/16 (267 × 637)	26 11/16 × 31 (678 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 25 (38 × 635)	2 @ 13 (330)
30 (762)	10 1/2 × 31 (267 × 787)	10 1/2 × 28 1/16 (267 × 713)	29 11/16 × 31 (755 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 28 (38 × 711)	2 @ 14 1/2 (369)
33 (838)	10 1/2 × 31 (267 × 787)	10 1/2 × 31 1/16 (267 × 789)	32 11/16 × 31 (831 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 31 (38 × 787)	2 @ 16 (406)
36 (814)	10 1/2 × 31 (267 × 787)	10 1/2 × 34 1/16 (267 × 866)	35 11/16 × 31 (907 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 34 (38 × 864)	2 @ 17 1/2 (445)

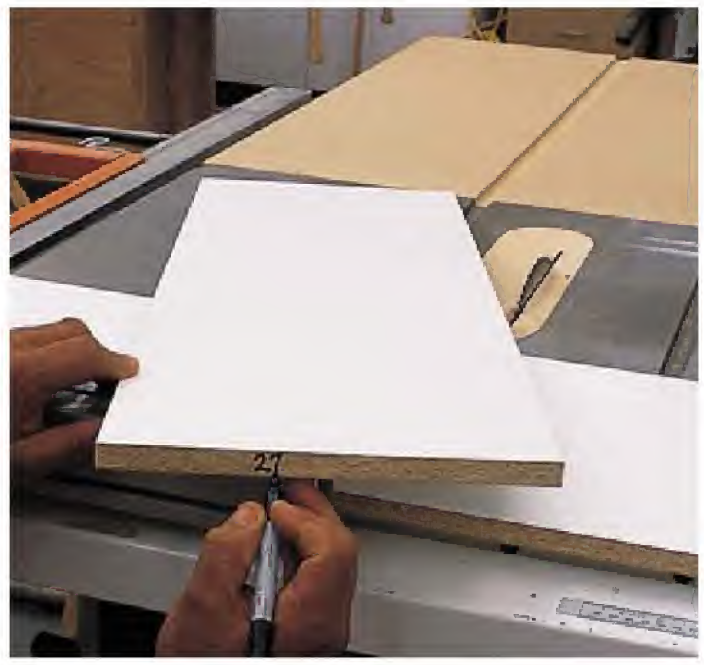
Building the Standard Wall-Hung Face-Frame Cabinet

1 Rip and crosscut the stiles and rails. Assemble each frame using glue and 2"-long screws in counterbored pilot holes. If the screw hole will be visible, fill the ⅜" counterbore with a wood plug. You can also use pocket holes, mortise-and-tenon joints, dowels or miniature biscuits to assemble the face frame.

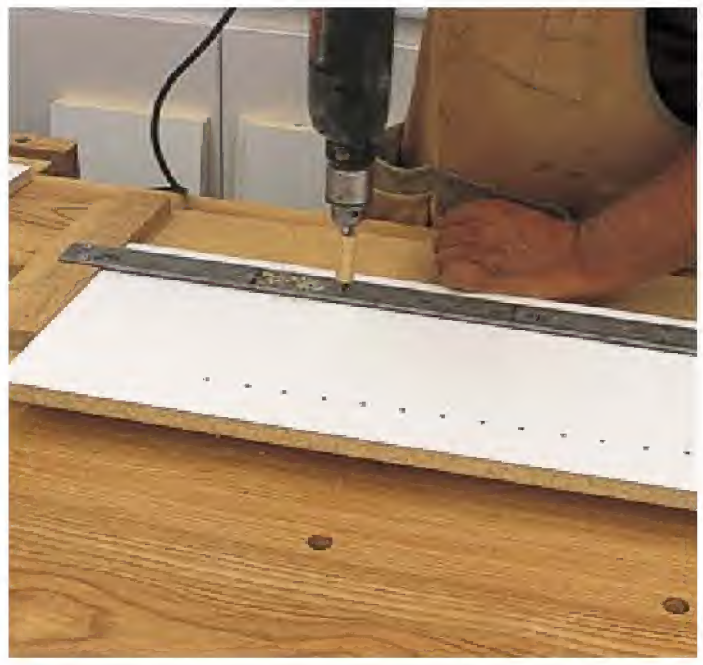
The face frames are constructed and sanded now so they can have two or three coats of finish applied. You can do the finishing while assembling cabinet carcasses so the face frame will be ready when it's time to attach it. Don't put any finish on the back face of the face frame so the glue can bond properly.



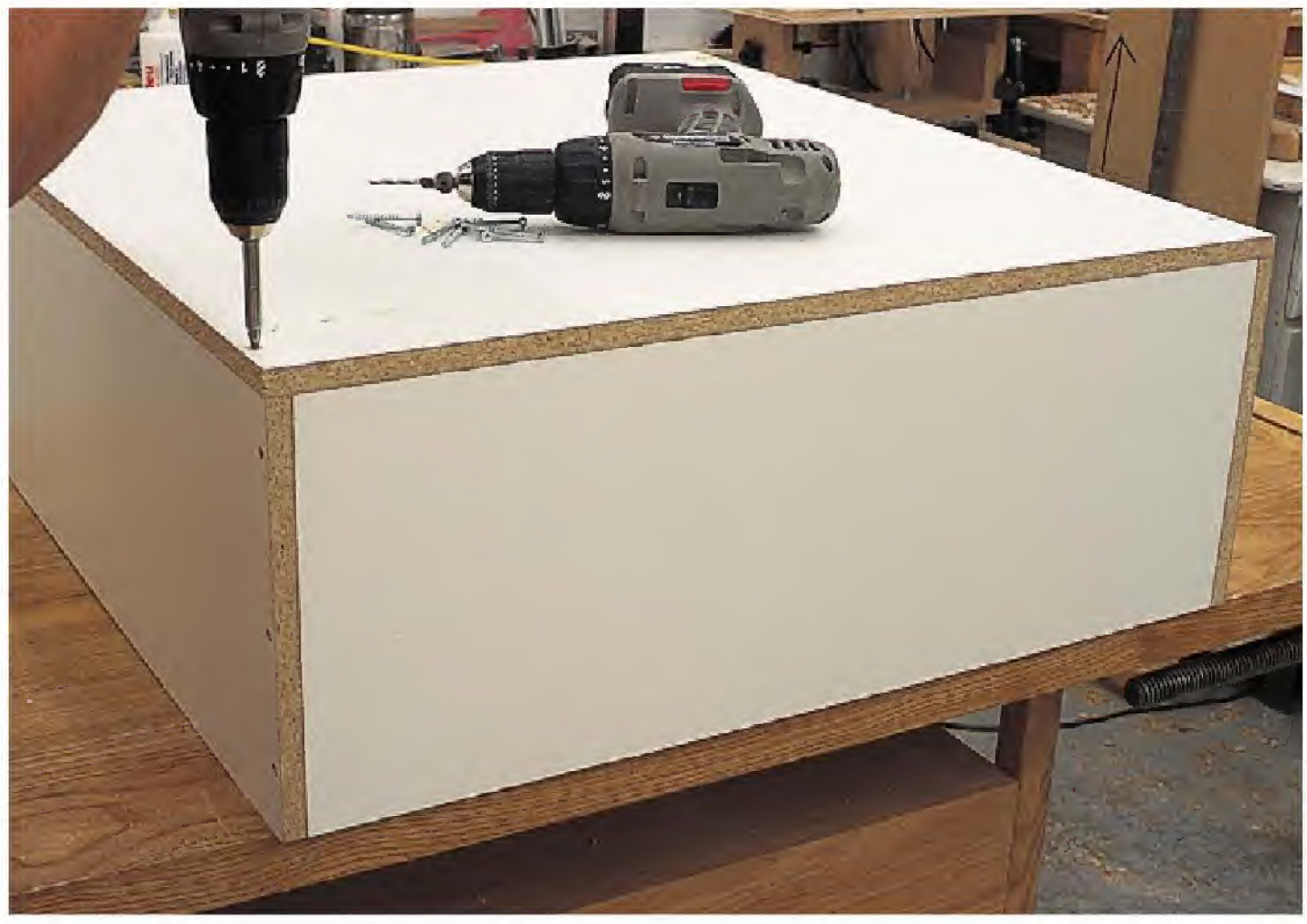
4 Fasten one side board to the edge of the bottom board. Drill a ⅛" countersunk pilot hole for each of the three 2" PB screws. Connect the remaining three corner butt joints in the same manner. Normally, with this face-frame style of cabinetry, the end gables that are exposed on any side will have a ¼"-thick veneer plywood covering to match the wood on the cabinet doors and face frames.



2 Cut the carcass parts to size. Number the parts as detailed on your cutting list and illustrations following the procedures described on page 22.



3 Drill the holes in each side board for the adjustable shelves, if needed. Be sure to mark the top of each panel. I normally start and end my columns of holes 4" from the top and bottom edges. The hole columns are placed 1" in from the back and front edges and are the diameter required for the shelf pins you plan to use. See the sidebar on page 36.



5 For purposes of verification at this point, referencing a 30" upper cabinet as an example, you should have a four-sided box with inside dimensions of 28⅛" wide (the width of the bottom and top carcass boards) by 29¾" high (the length of the side minus the thickness of the top and bottom carcass boards when using ⅝" sheet material).

Now, measure the actual width of the carcass. If the sheet material is slightly thicker than ⅝" or ¾", or your cutting on the top and bottom boards was a little strong, your carcass will be wider than planned. However, the backboard was cut slightly wider to accommodate that possibility. Trim the back to the correct size before attaching it to the carcass.

Secure the backboard to the carcass, flush with all edges of the box. This will force the cabinet corners into square. Install 2" PB screws at 6" centers around the perimeter of the back. Secure the first corner, aligning it square, then secure the remaining three corners while aligning the box. Install screws between the corners, aligning the sides, bottom and top boards flush with the edge of the backboard. Always drill pilot holes for the screws. Use a marking gauge to draw lines ⅝" in from the edges as a guide for the pilot holes.

6 Apply glue to the four carcass edges and place the face frame's outside top edge flush with the outside top edges of the carcass. The face frame should fully cover the carcass edges; it should, in fact, be slightly smaller on the inside dimension versus the inside dimension of the carcass. As detailed earlier, the carcass bottom and top are cut 1/16" larger than the face-frame rails to guarantee full carcass edge coverage by the face frame. Divide the difference between the two inside edges. Secure the top corner of the face frame to the carcass body using 2" finishing nails in pilot holes slightly smaller than the nail diameter. Drill the pilot hole so that it centers on the PB edge.

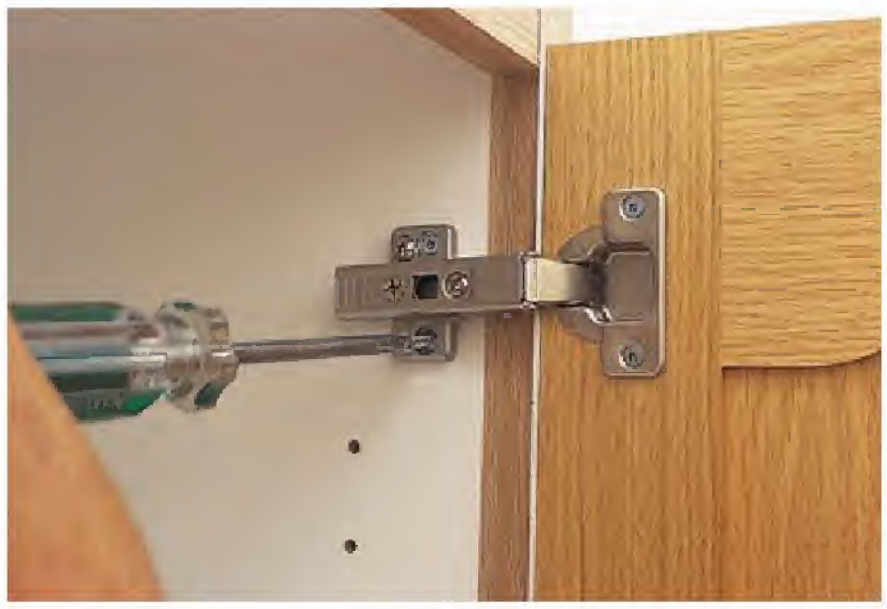
Secure the other top corner so that the top outside edge of the face frame is flush with the top outside edge of the carcass. Then, nail the bottom two corners, making sure that the slight overhang of the face frame inside the carcass is maintained equally on both sides. Install the remaining nails at 8" centers. The bottom rail should hang below the cabinet carcass by 3/4". When building with 5/8"-thick sheet material, the sides of the face frame should extend 3/8" beyond each side of the carcass; the sides should extend 1/4" for 3/4"-thick sheet goods. Also, the inside edge of the bottom rail will be slightly above the bottom board with 5/8" sheets, and flush with the top face of the bottom board when using 3/4"-thick sheet material.

If you don't like nailing the face frames, use biscuits for an invisible joint. Remember though, the door, in its normally open or closed position, covers the section of the face frame where the nails are located.

7 Pick the style of door you would like to install. Buy the doors from a supplier, or refer to page 116 and build your own doors. Door heights for standard cabinets with this building system are 30½" high. The width of each door is dependent on the size of the carcass. Use the 1" rule to determine the door width required: The doors are 1" wider than the inside stile-to-stile distance. If you require two doors, simply divide the door width required by two. For example, a 24"-wide face-frame upper has an inside dimension of 22". Add 1" and divide by two (22" + 1" = 23" divided by 2 = 11½"), meaning each door will be 11½" wide.

8 Drill a 35mm-diameter hole, 3" on center, from each end of the door. The edge of the hole should be 1/8" away from the door's edge. Use a hinge-boring bit to drill the hole 1/2" deep, or as specified by the hinge supplier.

Attach a 100° to 120° standard-opening hinge with two 5/8" screws, using a square to make sure the hinge arm is at 90° to the door's edge. Once the hinges are secure, attach the mounting plate to each hinge.



9 Hold the door in its normally open position, with the hinge and plate attached to the door, and place a 1/8"-thick spacer between the face-frame stile and back edge of the door. Drive screws through the hinge plate and into the cabinet side to secure the doors.

The doors adjust sideways, up and down, as well as closer or farther away from the cabinet. On many hinges, the screw closest to the door moves the door side to side, the farthest screw is used to minimize the gap between the cabinet edge and door. The hinge plate has a screw that can be loosened to move the door up and down. (See the adjustment instructions for your particular hinge.) Adjust both doors so the reveal is equal on both sides and there is a 1/16" gap between doors on a two-door cabinet.

To complete the standard upper cabinet, install shelf pins, test fit the shelves and attach handles or knobs of your choice. The shelf's front edge can be covered with iron-on melamine edge tape, cap moulding that's available at the home store or wood edge trim to match the doors.

Building a Shelf-Pin Drilling Jig

This jig is a handy shop tool. It will act as a guide for drilling accurately placed holes in cabinet sides up to 31" long. The flat steel is available at most hardware stores. All the other materials required are readily available from any home store.

1 Cut a piece of ¾" plywood that's 13" wide and 34 1/16" long. Attach two boards that are ¾" thick by 1½" wide by 10" long. Use four 1¼"-long screws per board. Install the boards flush at each end so there is 31 1/16" between them.

2 To help keep the cabinet sides oriented properly, mark the jig as shown. I note the top of the cabinet side with an X when drilling shelf holes on each board's edge.

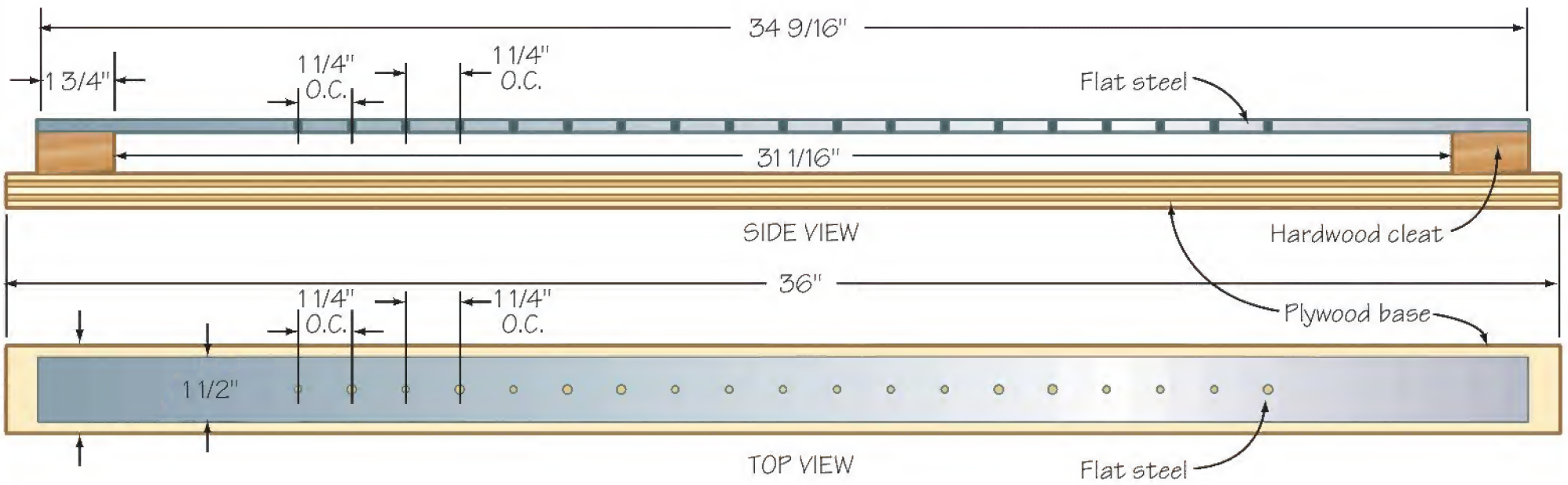
3 Prepare a piece of ¼"-thick flat steel that's 1½" wide by 34" long. Drill holes at 1¼" on center up the middle of the bar. If you prefer, you can increase or decrease the hole spacing. You should also decide which shelf pin you will be using and drill the guide holes to the diameter required for those pins. Locate two holes at either end of the flat steel and attach it to the end boards with 1½" screws.

4 The jig will accept cabinet sides up to ¾" thick and 31" long. If you want to drill shorter sides, put spacers in the jig to hold the cabinet side tight against the top board.

Drill one vertical set of holes and move the cabinet side over to drill the other set. Normally, each cabinet side will require two parallel sets of holes. Guide marks on the jig's end boards will help position the holes 1" in from each side board's edge.

5 Drilling through a piece of dowel rod makes a simple drill depth stop. Set the drill bit in the chuck, with the stop in place, so the bit can travel through the steel and approximately three-quarters of the way through a cabinet side. The stop will prevent the drill bit from exiting the finished face of the cabinet side. Make sure the hole is deep enough for the shelf pin to be properly seated and secure.

SHELF-PIN-HOLE DRILLING JIG



Leave 31 1/16" for gable end placement.
Drill 3/16" holes in the flat steel at 1 1/4" on center to guide drill bit.
Drill shelf-pin holes in gable ends at 1" from each edge.

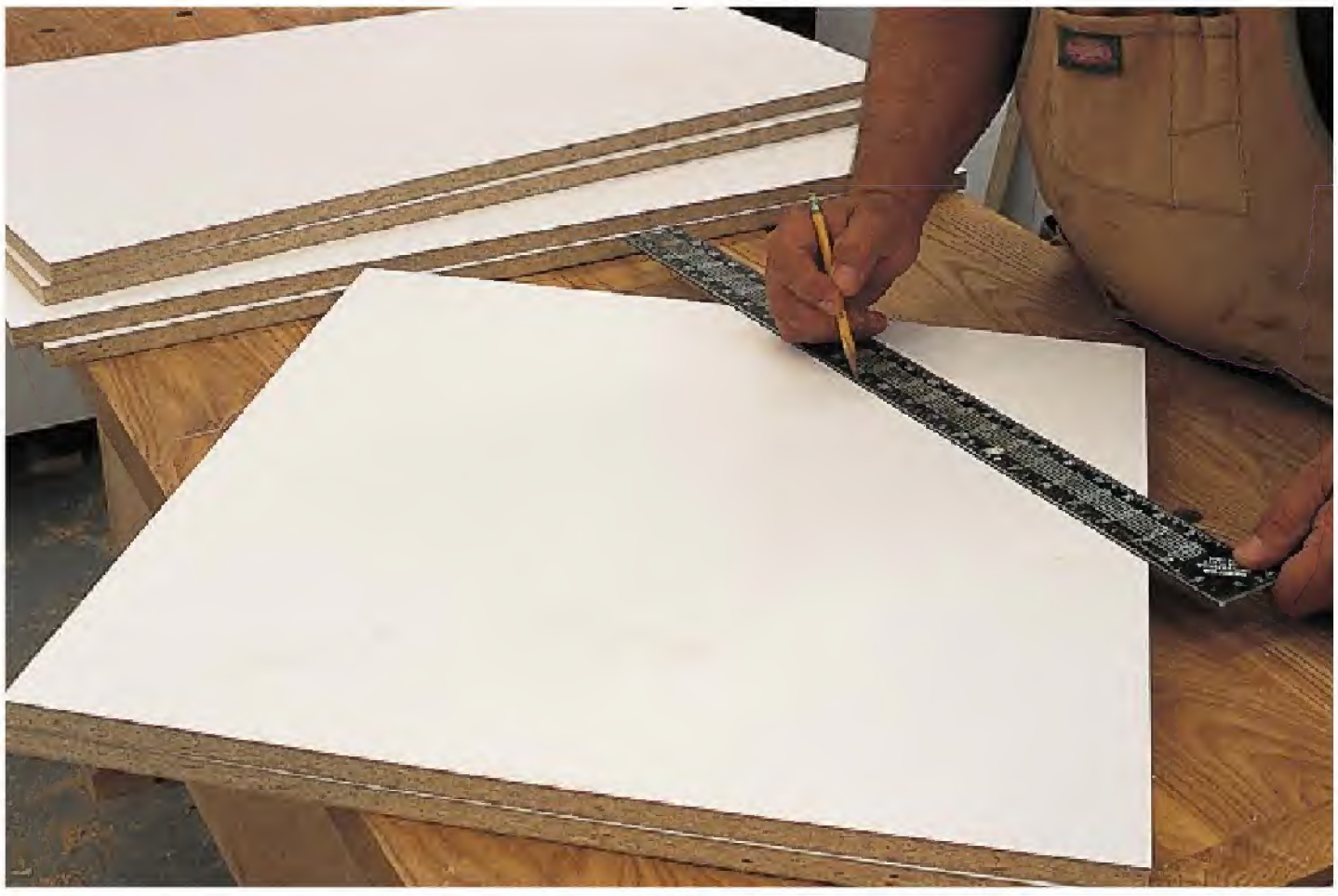
Building a Wall-Hung Corner Cabinet

An upper corner cabinet with a lazy Susan assembly is a popular and useful addition in any kitchen renovation project. If you skip the lazy susan, it also completes upper cabinets in any den, or office.

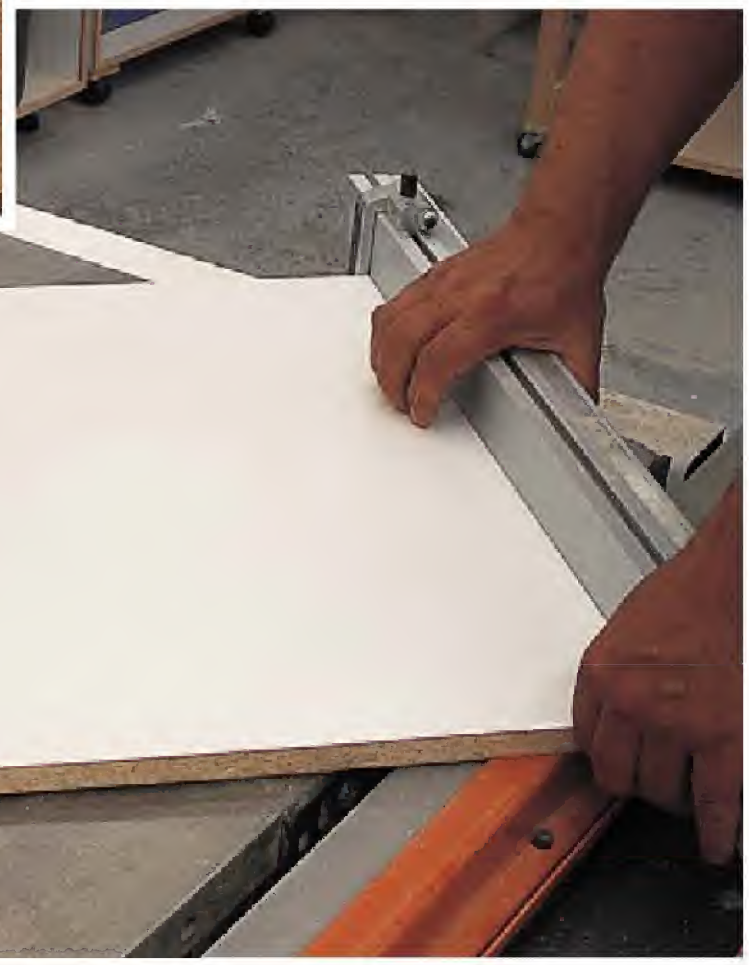
This cabinet is called a 24" upper corner because it covers 24" on each wall of a corner. The face is 45° to the cabinets on either side. Dead space, often found in corner wall cabinets, is minimized by the installation of a lazy Susan assembly.

Face-frame members need to be cut at 22½° angles so the two parts of each stile form a 45° angle. Cut the top and bottom boards to the size stated in the cutting list on page 41, leaving the angle cut until you are ready to assemble the pieces.

As illustrated in the cutting list, pay particular attention to the backboard cut sizes. One back is ⅝" or ¾" wider to allow for the required overlaps of the boards during assembly.

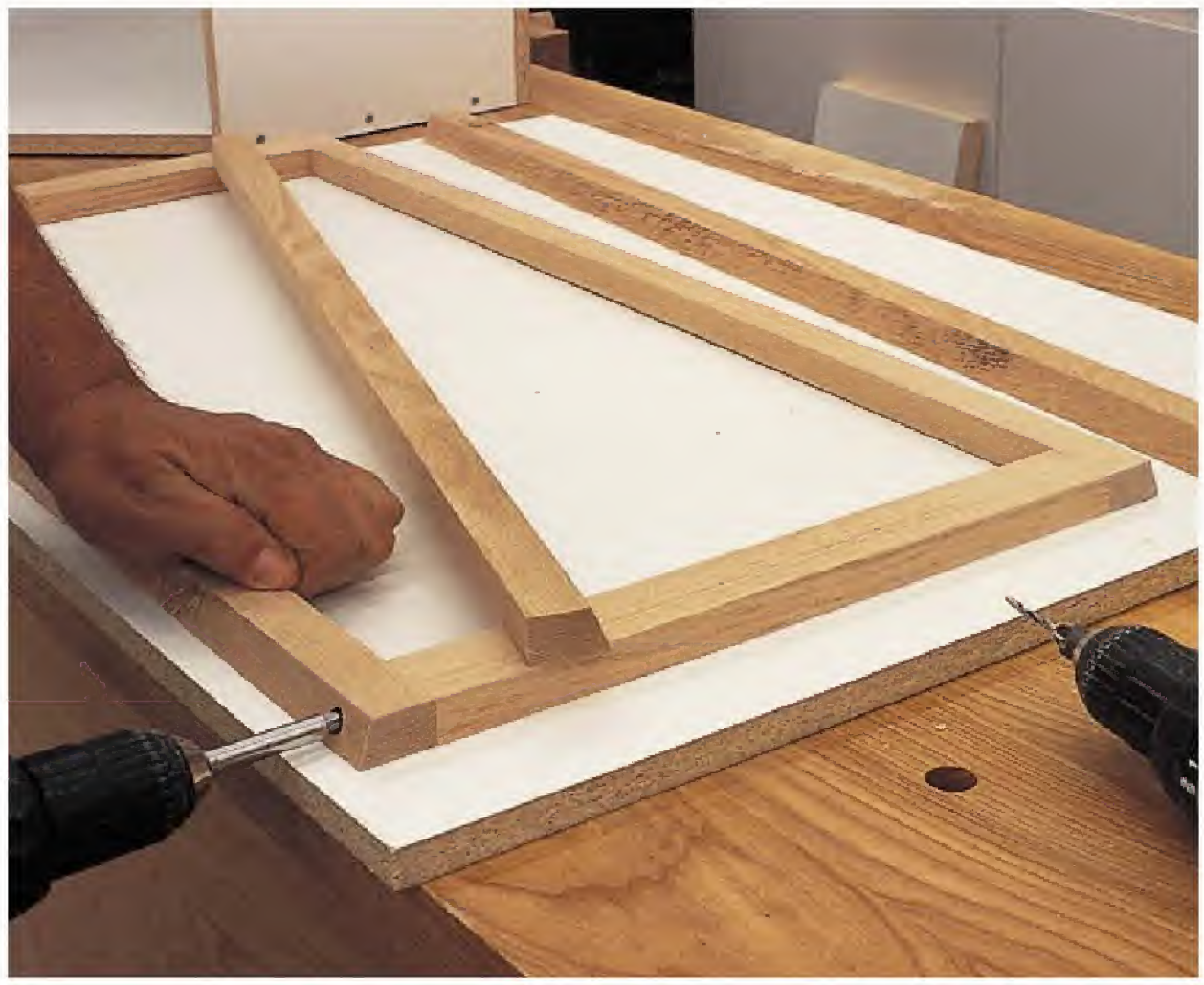


2 **BELOW** If you have a sliding table on your saw, or an angle-cutting jig, prepare the boards as indicated in the drawing on page 40. You can cut the front angles with a circular saw or jigsaw, keeping ⅛" away from the line, then dress the boards to the line with a belt sander. Take your time and you'll get an accurate cut with minimum chipping of the melamine coating.



1 **ABOVE** Six panels are required for this cabinet. It is almost always fitted with a two-shelf, 18"-diameter round lazy Susan assembly, and therefore holes for adjustable shelves are not required. Mark the angle cuts on the top and bottom boards.

3 Assemble the boards as shown in the drawing, making sure all joints are square. Note the position of the backboards and how each one overlaps at the corners during assembly.



4 Cut the six wood parts for the face frame and assemble as indicated. Use angle clamps to help hold the stiles in place while they are glued and screwed to each other. I normally attach the two inside stiles to the rails with glue and screws first. Then I secure the two outside stiles to the inside stiles, making sure the angle cuts are properly aligned with each other, using glue and four 1½" screws per side.

5 Glue and nail the face frame to the carcass as shown. Install the frame with the outside top edge flush with the outside top of the carcass. The inside surface of the stiles is not flush with the sides as in the other cabinets, so a special face-frame hinge plate is used to secure the hinges and door for this cabinet.

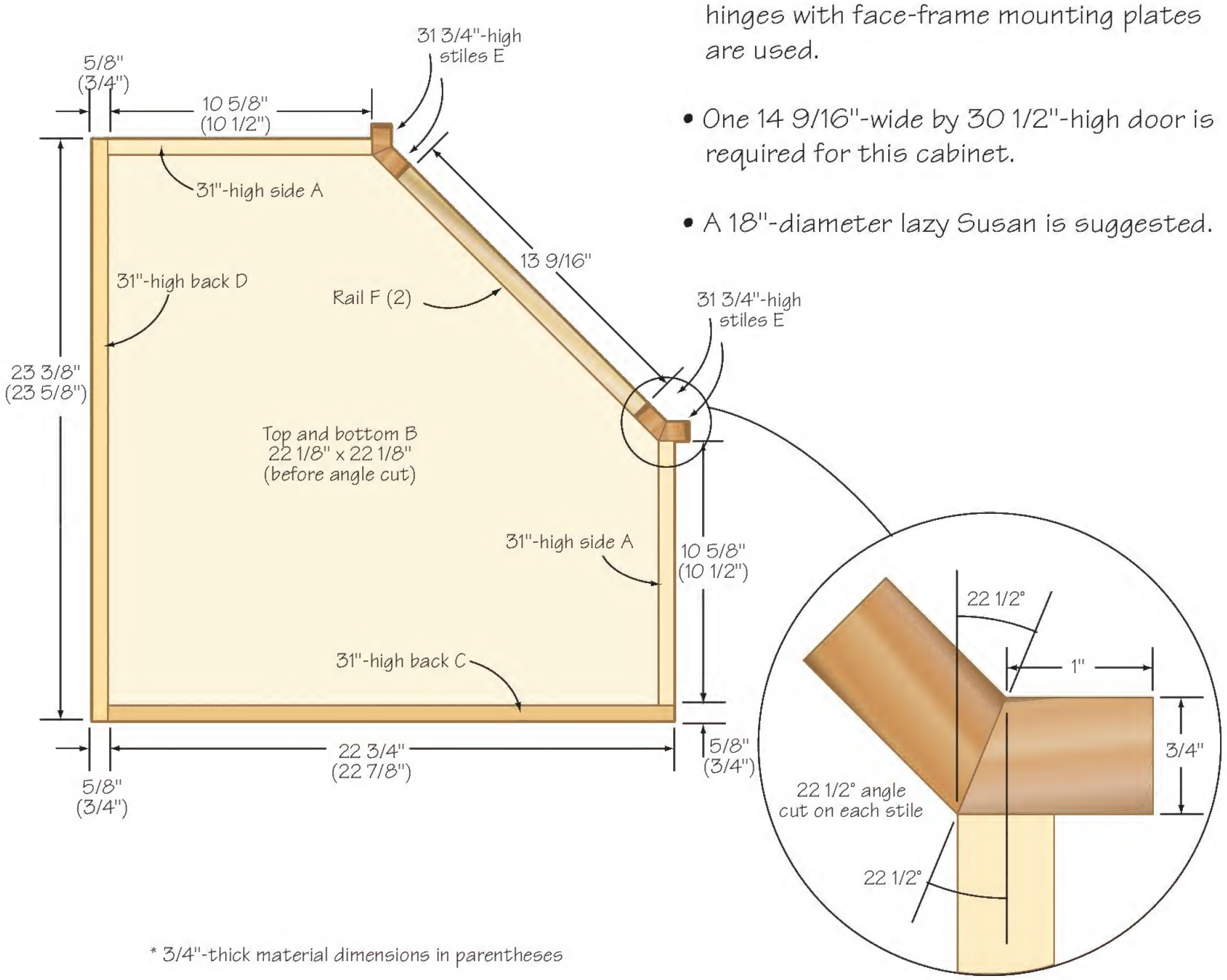
6 Two 170°-opening hinges are used for this cabinet door. The wide-opening hinges allow the door to swing farther so the cabinet can be easily accessed. The hinges attach to the inside edge of one stile with special face-frame hinge plates.

Note

You won't need a ⅛" spacer when installing the upper corner cabinet door using 170° hinges and face-frame mounting plates. Two small hooks on the face-frame mounting plate align it correctly on the inside edge of the stile.

24" UPPER CORNER CABINET

- Four stiles are required. Cut as illustrated to build the face frame for this cabinet.
- The inside stile is not flush with the inside surface of the gable end. European hidden hinges with face-frame mounting plates are used.
- One 14 9/16"-wide by 30 1/2"-high door is required for this cabinet.
- A 18"-diameter lazy Susan is suggested.



* 3/4"-thick material dimensions in parentheses

Shop Tip

Use a combination square set at half the thickness of the boards you are using to mark a screw-hole line as a guide for accurate drilling. How do you know what one-half of 5/8" or 3/4" or even 11/16" is? For that matter, any fraction? Simply double the bottom number of the fraction and that's half the distance. Try it out — half of 5/8" is 5/16", 3/4" is 3/8", 11/16" is 11/32", and so on. It works every time!

CUTTING LIST FOR A 24" (610MM) UPPER CORNER CABINET USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	5/8	(16)	10 5/8	(270)	31	(787)	
B	2	top & bottom	melamine pb	5/8	(16)	22 1/8	(562)	22 1/8	(562)	cut as illustrated
C	1	back	melamine pb	5/8	(16)	22 3/4	(578)	31	(787)	
D	1	back	melamine pb	5/8	(16)	23 3/8	(594)	31	(787)	
E	4	stiles	hardwood	3/4	(19)	1 1/2	(38)	31 3/4	(806)	rip 22 1/2° on one edge with 1"(25mm)-wide front face
F	2	rails	hardwood	3/4	(19)	1 1/2	(38)	13 9/16	(344)	
G	1	door		3/4	(19)	14 9/16	(370)	30 1/2	(775)	stock can be veneer pb or frame and panel hardwood

CUTTING LIST FOR A 24" (610MM) UPPER CORNER CABINET USING 3/4" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	3/4	(19)	10 1/2	(267)	31	(787)	
B	2	top & bottom	melamine pb	3/4	(19)	22 1/8	(562)	22 1/8	(562)	cut as illustrated
C	1	back	melamine pb	3/4	(19)	22 7/8	(581)	31	(787)	
D	1	back	melamine pb	3/4	(19)	23 5/8	(600)	31	(787)	
E	4	stiles	hardwood	3/4	(19)	1 1/2	(38)	31 3/4	(806)	rip 22 1/2° on one edge with a 1"(25mm)-wide front face
F	2	rails	hardwood	3/4	(19)	1 1/2	(38)	13 9/16	(344)	
G	1	door		3/4	(19)	14 9/16	(370)	30 1/2	(775)	stock can be veneer pb or frame and panel hardwood

Over-the-Stove Wall Cabinets

Stove cabinets are not as large as standard upper cabinets because a range hood is normally mounted under the cabinet and greater clearance between the stove and the upper cabinet is required to properly work at the stove.

I normally install a 30"-wide by 19¼"-high cabinet with 18"-high doors. These measurements are for cabinets over standard-size stoves. I use a 30"-wide cabinet with ½" added to the adjoining stiles of the cabinets on either side. I want the space between the base units that are on each side of the stove to be 31", and the wider upper stiles will let me accomplish this when the base cabinets are aligned with the uppers. I can then overhang my countertop ⅜" on each base cabinet to the right and left of the stove, which allows for a maximum opening, between the countertop ends, of 30¼" for the stove. Widening the cabinet stiles on the right and left of the stove upper permits countertop overhang and allows for proper clearance of the stove, as well as aligning the doors on the upper and lower cabinets on each side of the stove.

To custom design any size over-the-stove cabinet, you need the following design dimensions for upper cabinets. The basic rules of the inside width of the face frame equaling the inside width of the cabinet carcass (top and bottom board), the face frame being ¾" greater than the cabinet carcass in total height, and the doors being 1¼" less than the face-frame height, determine your cabinet dimensions. The door width equals the inside cabinet dimension plus 1" and, in the case of this 30" reduced-height upper, divide by two to find the width of each door.

The stove cabinet I normally use follows these rules. The face frame is 19¼" high, with two 14½"-wide by 18"-high doors, the inside carcass width is 28", and the sides are 18½" high. The backboard is the width of the bottom board plus the two thicknesses of the side boards. If you were using ⅝"-thick sheet material, the backboard would be 29¼" wide by 18½" high. The ¾" material would mean a backboard that's 29½" wide by 18½" high. The 28" inside cabinet width plus the total width of the two 1" stiles equals a cabinet that is 30" wide.

Over-the-Fridge Wall Cabinets

I use two sizes of cabinets as over-the-fridge cabinets. You have a choice based on your requirements.

The majority of refrigerators on the market today are 31" to 32" wide, so my normal cabinet width for either style is 33". I use a standard maximum cabinet height of 85" made up of a 36" base unit and countertop height, plus 18" countertop surface to the bottom of the upper cabinet distance, and 31" upper cabinet height. I want the top of the fridge cabinet even with the uppers at that 85" height. Refrigerators are approximately 65" high, leaving a clearance of about 20" for a cabinet above the appliance.

Your choice depends on how much clearance you would like between the bottom of the cabinet and the top of the fridge. A 17¼" cabinet with 16"-high standard doors will leave a 2¾" space, and a 14¼" cabinet with 13"-high standard doors will leave a 5¾" space.

Calculating parts for any cabinet can be easily accomplished by working backwards from the door dimension. The over-the-fridge cabinet, called a 17¼"-high upper (the height of the face-frame stiles), takes 16"-high doors. We know, based on the standard design rules, that there is a 1¼" space above the door, therefore our face frame is 17¼" high.

Each door is 16". Since the stiles on a regular face frame are 1" wide, the bottom and top board of this cabinet must be 31" wide. Also, the standard face frame hangs ¾" below the cabinet bottom and is flush with the top, so our sides must be 16½" high. The backboard is the height of the sides and as wide as the bottom or top board plus the thickness of the two sides. Backboard width for ⅝"-thick sheet stock is 32¼", and 31½" when ¾"-thick sheet material is used.

Cabinet depth on this upper is a matter of personal choice. Some people like the look of a recessed cabinet (standard 12" depth) over the fridge, while others want a cabinet flush with the appliance door. Simply adjust the depth of the sides, top and bottom board while taking into account the thickness of the face frame and the cabinet door to get the desired total cabinet depth.

Over-the-Sink Wall Cabinets

Clearance is required when working at the sink, therefore over-the-sink cabinets, when installed, are not normally full-height cabinets. Standard widths are used (a 36"-wide cabinet in most cases); however, the height is the same as the over-the-stove cabinet at 19¼".

This reduced-height sink upper is by no means a hard-and-fast design rule. I have used both standard full-height and reduced-height uppers over the sink. I will usually install undercabinet lighting on this cabinet, as discussed in chapter six. In kitchens without a window over the sink cabinet, task lighting is a practical feature.

base face-frame cabinets

The standard base face-frame cabinet differs from the standard upper face-frame cabinet in two areas — the lack of a carcass top board and the addition of adjustable legs.

No top board is needed, as the kitchen countertop covers the base cabinet. The countertop is secured with screws and right-angle clips. This method, along with the face frame, gives the installed base cabinet its strength and rigidity. I use ¾" × ¾" metal right-angle clips, two per side, two on the backboard, and one in the center of the face-frame rail. The countertop is secured with two ⅝" screws through each right-angle clip.

Adjustable cabinet legs are used, replacing the base frame that was common with older-style kitchens. These legs simplify cabinet installation

and hold the kick plate by means of special clips called plinth clips. The adjustable cabinet legs are popular and can be purchased at kitchen hardware supply stores. The total cost of the legs for each cabinet is greater than the cost of the material for a wood base. However, the building time for the base, when added to the difficulty of cabinet installation, justifies the few extra dollars.

Most legs adjust from 3¾" to 5" in height. In effect, the kitchen floor would have to be out of level by more than 1" before the legs require shims.

Base cabinets are multifunction units. They are equipped with adjustable shelves, pullout shelf assemblies, drawers or other special features such as trash and recycling containers. Holes for the adjustable shelves are drilled in the carcass sides by the same method, and with the same jig assembly, as the standard upper cabinets. Drawers and pullouts are easily installed using the European bottom-mount drawer-glide hardware.

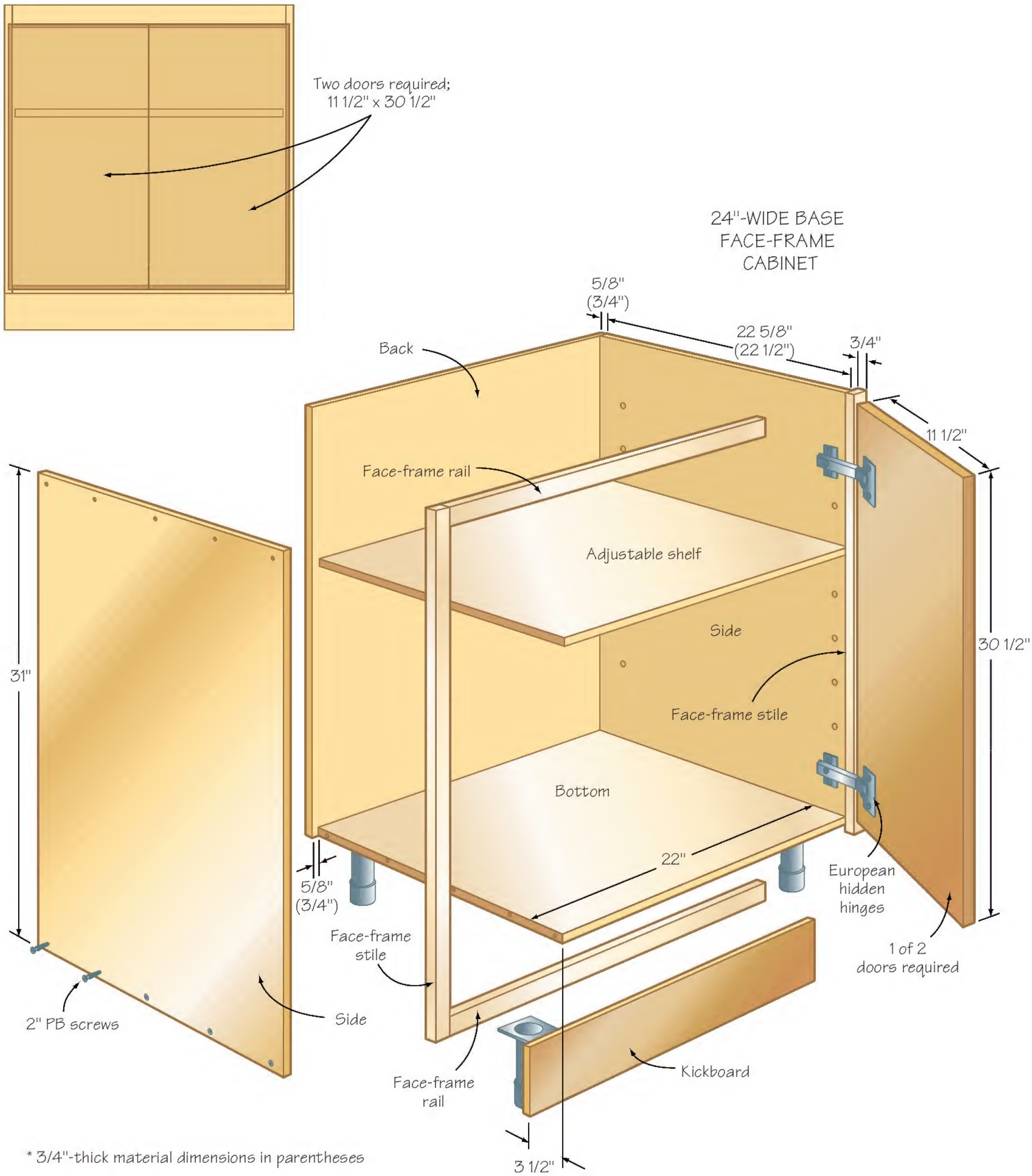
Accessories for kitchen base cabinets, such as pullout wire baskets, towel racks, laundry hampers, double, triple and quadruple recycling bin systems, as well as flip-out ironing boards and work-center platforms, can be found in most home centers.

Remember the principles of construction that I detailed for the upper cabinets. The bottom board is always 2" narrower than the cabinet exterior on this face-frame design. Cabinet width is always measured at the widest point on the front of the cabinet. For example, if the cabinet we want to build is 30" wide and we know that the stiles are each 1" wide, our bottom board is 28" wide. This will make the inside face of each stile flush with the inside face of the cabinet sides, allowing us to use European hinges.

The stiles are ¾" longer than the cabinet sides, and the face-frame rails are 1/16" narrower than the cabinet bottom board. The backboard is equal to the cabinet's inside dimension plus the two thicknesses of side boards. For a 30" cabinet, our backboard must be 29¼" wide when building with ⅝" sheet material.

The backboard is cut ⅛" wider than the total width of the bottom board plus the two side thicknesses. This is a first cut when I'm ripping all my sheet materials to size. If there is any thickness variance in the sheet material, most often thicker than the stated ⅝" or ¾", I will be able to trim the width after measuring the assembled box and before I attach the backboard.

Standard base cabinets usually have one shelf installed on adjustable pins. The shelves are cut 1/16" narrower than the bottom boards to make them easier to install and move. Door width is determined by adding 1" to the interior width. If it's only one door, that's the final width. If two doors are needed, divide the interior-width-plus-1" formula by two. A 30" cabinet would need two 14½"-wide doors mounted on European hidden hinges.



* 3/4"-thick material dimensions in parentheses

CUTTING LIST FOR BASE CABINETS USING 5/8"-THICK (16MM) SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX			FACE FRAME		
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	BOTTOM DEPTH × WIDTH	ONE BACK WIDTH × HEIGHT	TWO STILES WIDTH × HEIGHT	TWO RAILS HEIGHT × WIDTH	DOOR WIDTH 30 1/2" HIGH (775)
12 (305)	22 5/8 × 31 (575 × 787)	22 5/8 × 10 1/16 (575 × 256)	11 7/16 × 31 (290 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 10 (38 × 254)	1 @ 11 (279)
15 (381)	22 5/8 × 31 (575 × 787)	22 5/8 × 13 1/16 (575 × 332)	14 7/16 × 31 (367 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 13 (38 × 330)	1 @ 14 (356)
18 (457)	22 5/8 × 31 (575 × 787)	22 5/8 × 16 1/16 (575 × 408)	17 7/16 × 31 (443 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 16 (38 × 406)	1 @ 17 (432)
21 (533)	22 5/8 × 31 (575 × 787)	22 5/8 × 19 1/16 (575 × 485)	20 7/16 × 31 (519 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 19 (38 × 483)	2 @ 10 (254)
24 (610)	22 5/8 × 31 (575 × 787)	22 5/8 × 22 1/16 (575 × 561)	23 7/16 × 31 (595 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 22 (38 × 559)	2 @ 11 1/2 (292)
27 (686)	22 5/8 × 31 (575 × 787)	22 5/8 × 25 1/16 (575 × 637)	26 7/16 × 31 (671 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 25 (38 × 635)	2 @ 13 (330)
30 (762)	22 5/8 × 31 (575 × 787)	22 5/8 × 28 1/16 (575 × 713)	29 7/16 × 31 (748 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 28 (38 × 711)	2 @ 14 1/2 (369)
33 (838)	22 5/8 × 31 (575 × 787)	22 5/8 × 31 1/16 (575 × 789)	32 7/16 × 31 (824 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 31 (38 × 787)	2 @ 16 (406)
36 (914)	22 5/8 × 31 (575 × 787)	22 5/8 × 34 1/16 (575 × 866)	35 7/16 × 31 (900 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 34 (38 × 864)	2 @ 17 1/2 (445)

CUTTING LIST FOR BASE CABINETS USING 3/4"-THICK (19MM) SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX			FACE FRAME		
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	BOTTOM DEPTH × WIDTH	ONE BACK WIDTH × HEIGHT	TWO STILES WIDTH × HEIGHT	TWO RAILS HEIGHT × WIDTH	DOOR WIDTH 30 1/2" HIGH (775)
12 (305)	22 1/2 × 31 (572 × 787)	22 1/2 × 10 1/16 (572 × 256)	11 11/16 × 31 (297 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 10 (38 × 254)	1 @ 11 (279)
15 (381)	22 1/2 × 31 (572 × 787)	22 1/2 × 13 1/16 (572 × 332)	14 11/16 × 31 (374 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 13 (38 × 330)	1 @ 14 (356)
18 (457)	22 1/2 × 31 (572 × 787)	22 1/2 × 16 1/16 (572 × 408)	17 11/16 × 31 (450 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 16 (38 × 406)	1 @ 17 (432)
21 (533)	22 1/2 × 31 (572 × 787)	22 1/2 × 19 1/16 (572 × 485)	20 11/16 × 31 (526 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 19 (38 × 483)	2 @ 10 (254)
24 (610)	22 1/2 × 31 (572 × 787)	22 1/2 × 22 1/16 (572 × 561)	23 11/16 × 31 (602 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 22 (38 × 559)	2 @ 11 1/2 (292)
27 (686)	22 1/2 × 31 (572 × 787)	22 1/2 × 25 1/16 (572 × 637)	26 11/16 × 31 (678 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 25 (38 × 635)	2 @ 13 (330)
30 (762)	22 1/2 × 31 (572 × 787)	22 1/2 × 28 1/16 (572 × 713)	29 11/16 × 31 (755 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 28 (38 × 711)	2 @ 14 1/2 (369)
33 (838)	22 1/2 × 31 (572 × 787)	22 1/2 × 31 1/16 (572 × 789)	32 11/16 × 31 (831 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 31 (38 × 787)	2 @ 16 (406)
36 (914)	22 1/2 × 31 (572 × 787)	22 1/2 × 34 1/16 (572 × 866)	35 11/16 × 31 (907 × 787)	1 × 31 3/4 (25 × 806)	1 1/2 × 34 (38 × 864)	2 @ 17 1/2 (445)

Cabinet Sizes

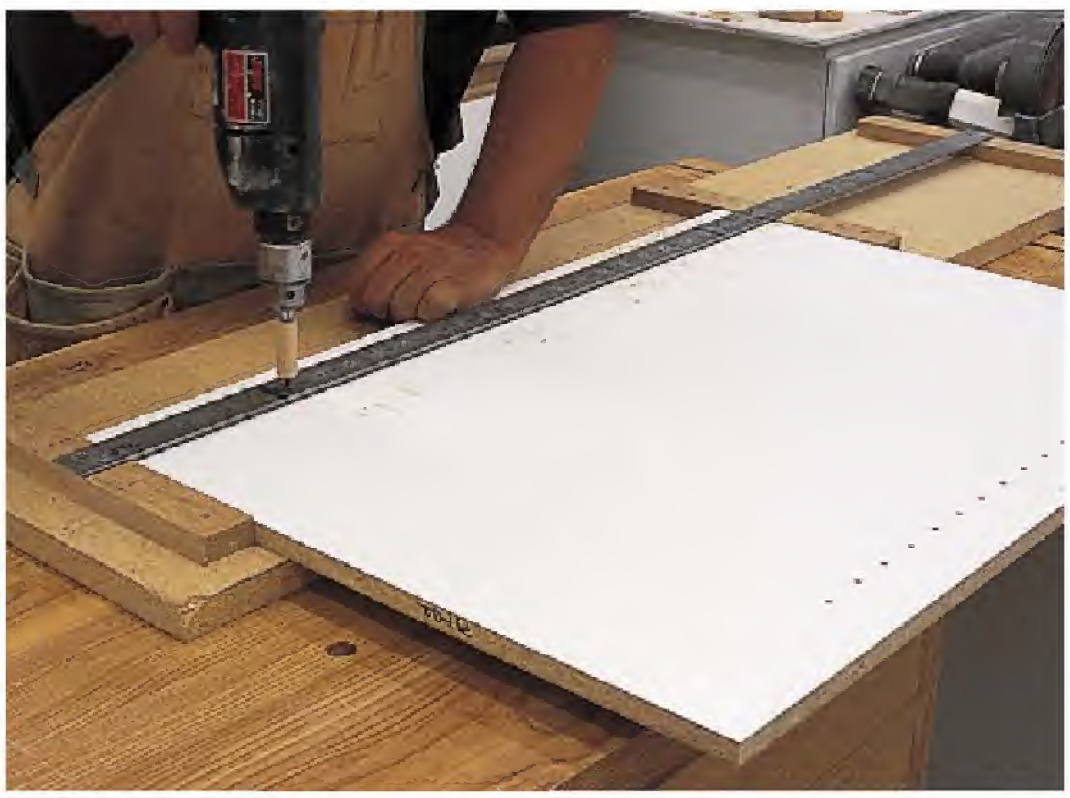
Two cutting lists are shown. One is for construction of standard base cabinets using 5/8"-thick material, and the other is for 3/4"-thick material. They are sample widths, however; the components for any cabinet width can be calculated by following the construction principles.

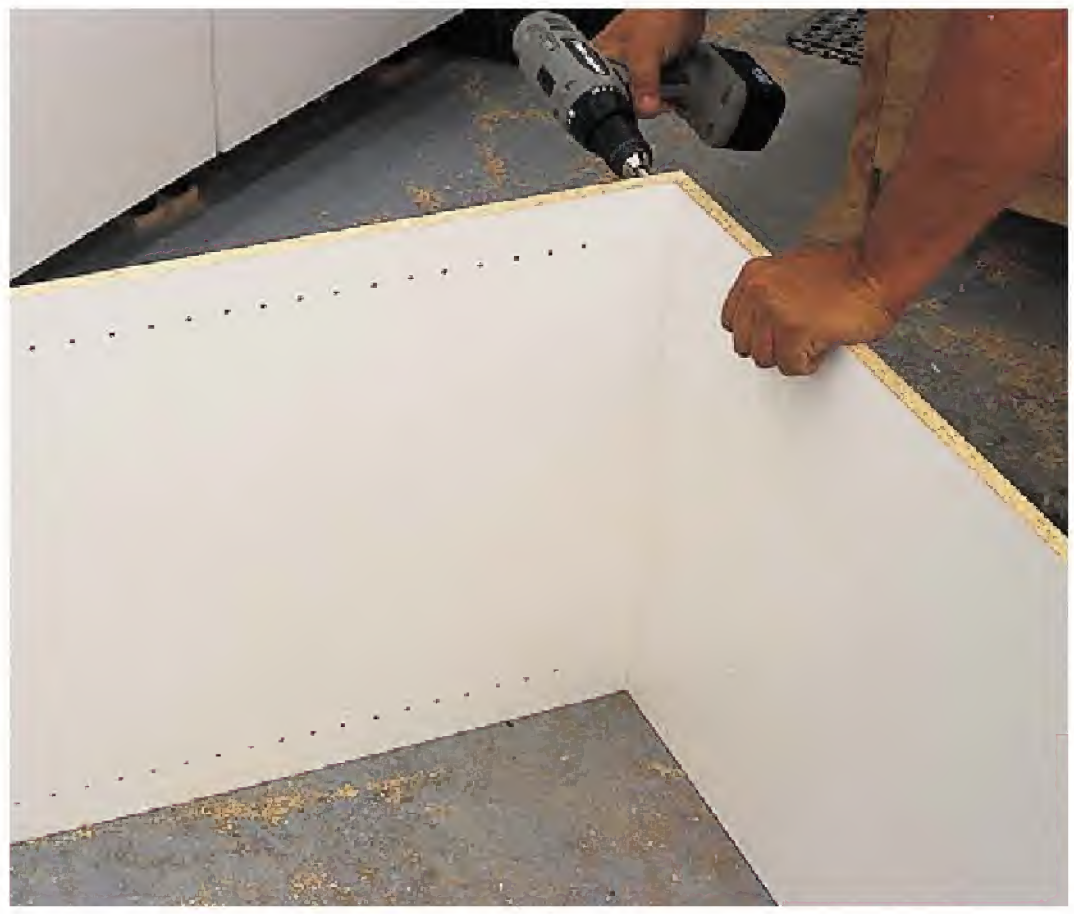
Standard Base Face-Frame Cabinet

1 Rip and crosscut the stiles and rails. Assemble each frame using glue and 2"-long screws in counterbored pilot holes. If the screw hole will be visible, fill the ⅜" counterbore with a wood plug. You can also use pocket holes, mortise-and-tenon joints, dowels or miniature biscuits to assemble the face frame.

The face frames are constructed and sanded now so they can have two or three coats of finish applied. You can do the finishing while assembling cabinet carcasses so the face frame will be available when it's time to attach it. Don't put any finish on the back face of the face frame so the glue can properly bond.

2 Cut the carcass parts to size. Number the parts as detailed on your cutting list and diagrams following the procedures found on page 22.





3 Drill the holes in each side board for the adjustable shelf, if needed. (If you plan to install a pullout shelf holes are not required.) Be sure to mark the top of each panel. I normally start and end my columns of holes 4" from the top and bottom edges. The hole columns are placed 1" in from the back and front edges and are the diameter required for the shelf pins you plan to use. You can use your shelf-pin-hole drilling jig from the previous chapter.

4 Fasten one side board to the edge of the bottom board, making sure the joint is square and flush. Drill a ⅛" countersunk pilot hole for each of the four 2" PB screws. Do not overtighten or apply so much force to the screws that they strip their threaded hole. Take care as well to drill the pilot hole so that it's in the center of the edge on the board you are fastening the side to; in this case, the bottom board of the carcass. Fasten the other side board to the bottom following the same process.

Once again, you have joinery options at this point. You can use biscuits, dowels or confirmat screws. Normally, with this face-frame style of cabinetry, the end gables that are exposed on any side will have a ¼"-thick veneer plywood covering to match the wood on the cabinet doors and face frames.

5 For purposes of verification at this point, referencing a 30" base cabinet as an example, you should have a three-sided box with inside dimensions of 28 1/16" wide (the width of the bottom board) by 30 3/8" high (the length of the side minus the thickness of the bottom carcass board when using 5/8" sheet material).

Now, measure the actual width of the carcass. If the sheet material is slightly thicker than 5/8" or 3/4", or your cutting on the top and bottom boards was a little strong, your carcass will be wider than planned. However, the backboard was cut slightly wider to accommodate that possibility. Trim the back to the correct size before attaching it to the carcass.

Secure the backboard to the carcass, flush with all edges of the box. This will force the cabinet corners into square. Remember, the backboard was intentionally cut wider to accommodate thickness variances in the PB material.

Install 2" PB screws at 6" centers around the perimeter of the back. Secure upper corners first, aligning the backboard top edge to the side board's top edges, then secure the two bottom corners while aligning the box. Finally, install screws between the corners, aligning the sides and bottom boards flush with the edge of the backboard. Use a marking gauge to draw lines 5/16" in from the edges as a guide for the pilot holes.

6 Apply glue to the three carcass edges and place the face frame's outside top edge flush with the outside top edges of the side boards. Align the tops of the side boards with the face frame to match the slight overhangs at the bottom of your carcass. The face frame should fully cover the carcass edges; it should, in fact, be slightly smaller on the inside dimension versus the inside dimension of the carcass. As detailed earlier, the carcass bottom is cut 1/16" larger than the face-frame rails to guarantee full carcass edge coverage by the face frame. Divide the difference between the two inside edges. Secure the top corner of the face frame to the carcass body using 2" finishing nails in pilot holes slightly smaller than the nail thickness. Drill the pilot hole so that it centers, as much as possible, on the PB edge.

Secure the other top corner so that the top outside of the face frame is flush with the top outside edge of the carcass. Nail the bottom two corners, making sure that the slight overhang of the face frame inside the carcass is maintained equally on both sides. Install the remaining nails at 8" centers, maintaining the overhang. The bottom rail should hang below the cabinet carcass by 3/4". When building with 5/8"-thick sheet material, the sides of the face frame should extend 3/8" beyond each side of the carcass; the sides should extend 1/4" for 3/4"-thick sheet goods. Also, the inside edge of the bottom rail will be slightly above the bottom board with 5/8" sheets, and flush with the top face of the bottom board when using 3/4"-thick sheet material.

7 Attach right-angle brackets on the carcass side and backboards, as well as the back of the upper face-frame rail. Use two brackets per section and secure them with 5/8"-long screws. The bracket should be flush or slightly below the top edge of each panel, so the countertop will be drawn down to the carcass.

8 The cabinet legs are attached with four 5/8"-long screws through the flange. The cabinet legs you purchase may not have a flange with screw holes and may require installation with a thick bolt through the cabinet bottom board. Refer to the installation instructions that came with the legs.

The leg flanges are positioned to support the back and side boards. The front legs are set back 3 1/2" for a kick space. If this cabinet is an end-of-run unit, open on one side, set back the legs by 3 1/2" on that open side as well. The kick plate is clipped to the legs with plinth clips that are screwed to the back of the board.

9 Pick the style of door you would like to install. Buy your doors from a supplier, or refer to page 116 to build your own doors. Door heights for standard cabinets with this building system are 30½" high. The width of each door is dependent on the size of the carcass. Use the 1" rule as discussed in previous chapters. To review, the doors are 1" wider than the inside stile-to-stile distance. If you require two doors, simply divide the door width by two. For example, a 24"-wide face-frame base has an inside dimension of 22". Add 1" and divide by two (22" + 1" = 23" divided by 2 = 11½"), meaning each door will be 11½" wide.

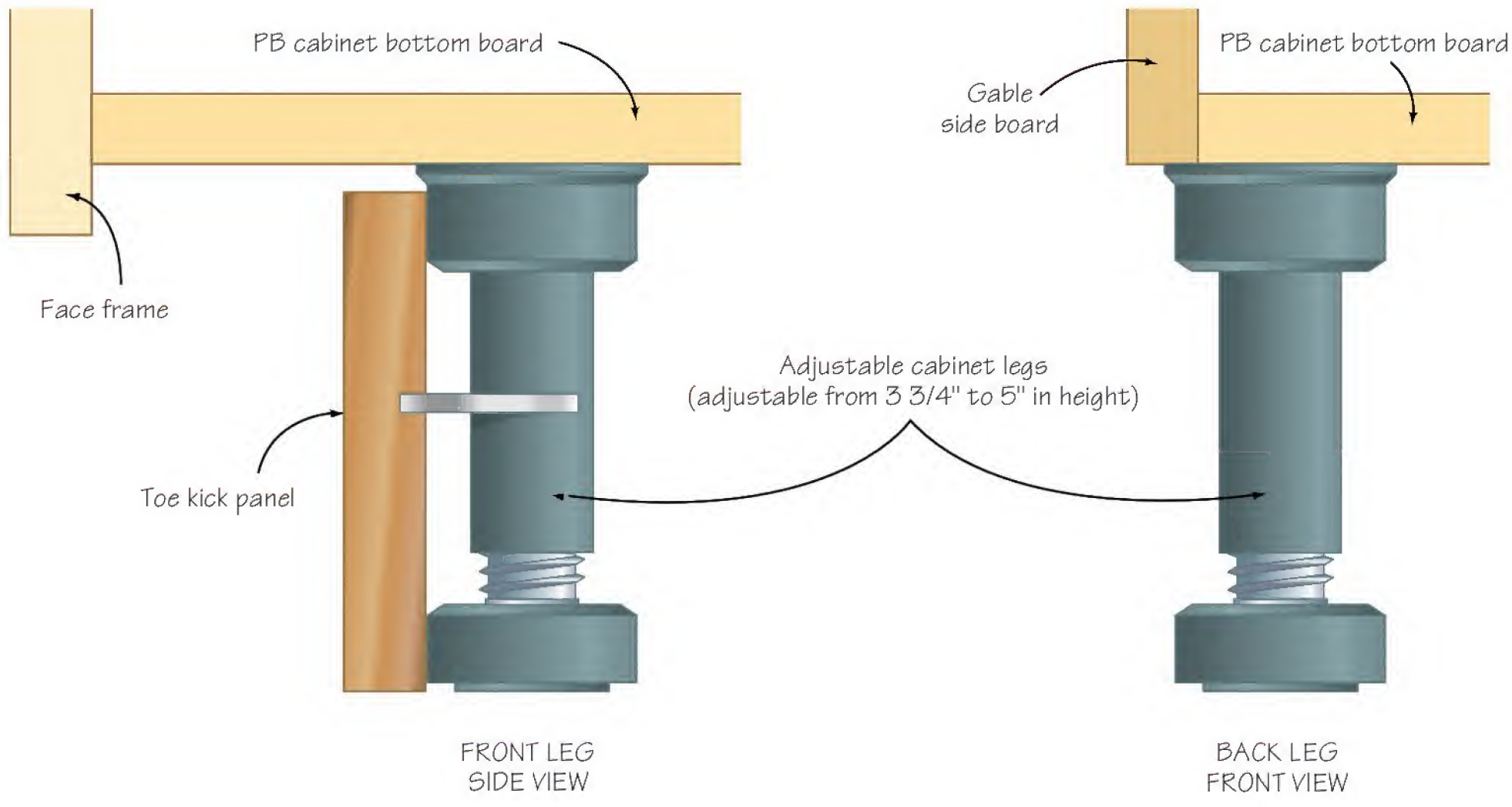
11 Hold the door in its normally open position, with the hinge and plate attached to the door, and place a ⅛"-thick spacer between the face-frame stile and back edge of the door. Drive screws through the hinge plate and into the cabinet side to secure the doors.

10 Drill a 35mm-diameter hole, 3" on center, from each end of the door. The edge of the hole should be ⅛" away from the door's edge. Use a hinge-boring bit to drill the hole ½" deep, or as specified by the hinge supplier.

Attach a 100° to 120° standard-opening hinge with two ⅝" screws, using a square to make sure the hinge arm is at 90° to the door's edge. Once the hinges are secure, attach the mounting plate to each hinge.

The doors adjust sideways, up and down, as well as closer or farther away from the cabinet. On many hinges, the screw closest to the door moves the door side to side, and the farthest screw is used to minimize the gap between the cabinet edge and door. The hinge plate has a screw that can be loosened to move the door up and down. (See the adjustment instructions for your particular hinge.) Adjust both doors so the reveal is equal on both sides and there is a 1/16" gap between doors on a two-door cabinet.

To complete the standard base cabinet, install shelf pins, test fit the shelves and attach handles or knobs of your choice. The shelf's front edge can be covered with iron-on melamine edge tape, cap moulding that's available at the home store or wood edge trim to match the doors.



A 36" Corner Base Cabinet

One of the most popular and effective storage options for kitchens is the 36" corner base cabinet equipped with a 32" lazy Susan assembly. This cabinet eliminates the lower dead zone in base cabinets at the point where two cabinets meet in the corner. I'm sure everyone can remember crawling into a corner base to find a misplaced pot. It's frustrating, and that four square feet of space is often ignored. Unless you have a kitchen the size of a tennis court, that space is valuable real estate.

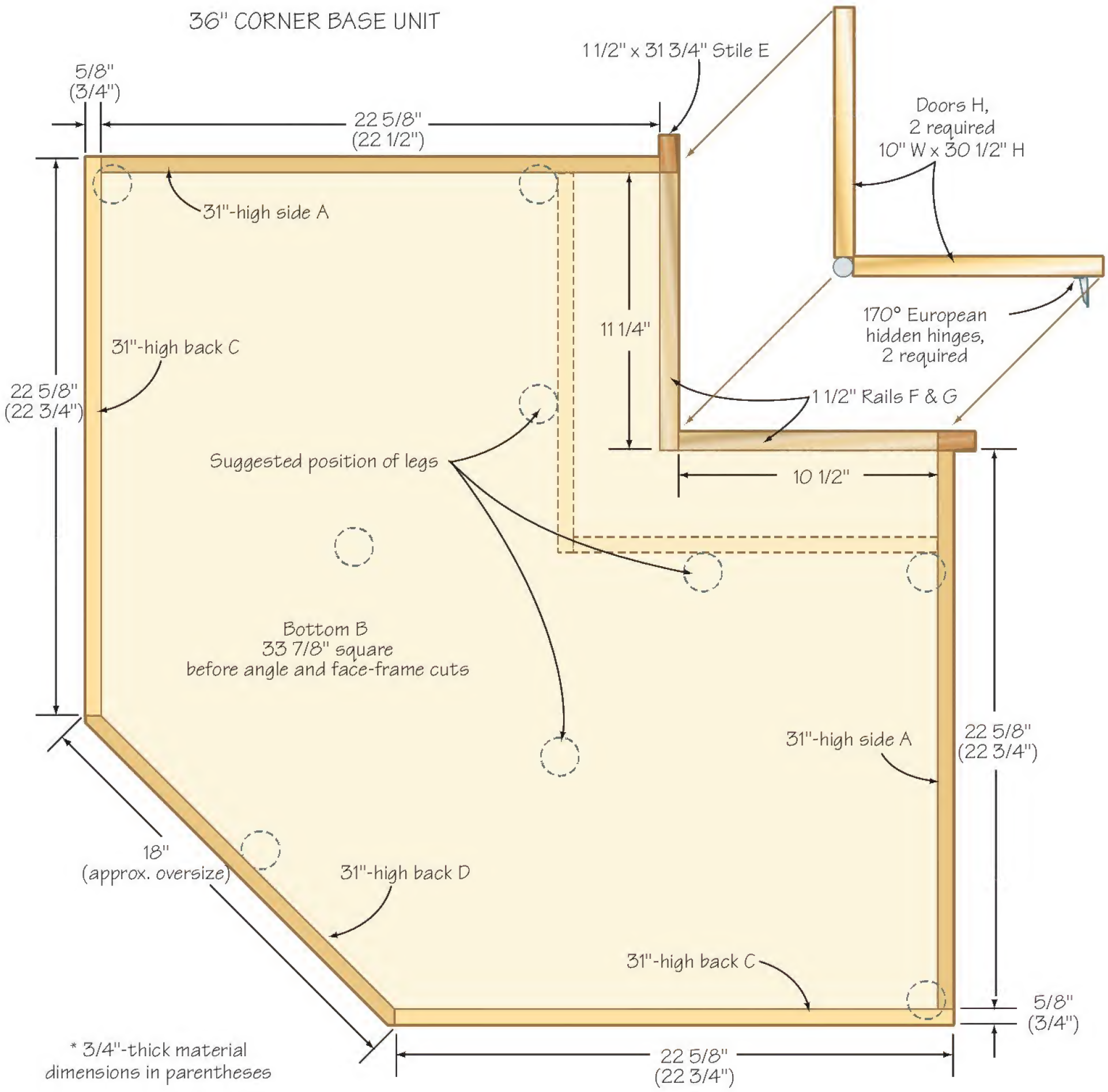
A two-shelf rotating lazy Susan assembly can be purchased at most major hardware stores. Installation is a simple matter with the supplied instructions. Major manufacturers such as Rev-A-Shelf produce a high-quality assembly that will last many years.

CUTTING LIST FOR A 36" (914MM) CORNER BASE CABINET USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	5/8	(16)	22 5/8	(575)	31	(787)	
B	1	bottom	melamine pb	5/8	(16)	33 7/8	(860)	33 7/8	(860)	cut as illustrated
C	2	backs	melamine pb	5/8	(16)	22 5/8	(575)	31	(787)	
D	1	back	melamine pb	5/8	(16)	18	(457)	31	(787)	cut oversize, then sides are angle-cut at 45° to fit
E	2	stiles	hardwood	3/4	(19)	1 1/2	(38)	31 3/4	(806)	
F	2	rails	hardwood	3/4	(19)	1 1/2	(38)	11 1/4	(285)	
G	2	rails	hardwood	3/4	(19)	1 1/2	(38)	10 1/2	(267)	
H	2	doors		3/4	(19)	10	(254)	30 1/2-high	(775)	stock can be wood-veneer pb or frame and panel hardwood

CUTTING LIST FOR A 36" (914MM) CORNER BASE CABINET USING 3/4" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	3/4	(19)	22 1/2	(572)	31	(787)	
B	1	bottom	melamine pb	3/4	(19)	33 3/4	(857)	33 3/4	(857)	cut as illustrated
C	2	backs	melamine pb	3/4	(19)	22 3/4	(578)	31	(787)	
D	1	back	melamine pb	3/4	(19)	18	(457)	31	(787)	cut oversize, then sides are angle-cut at 45° to fit
E	2	stiles	hardwood	3/4	(19)	1 1/2	(38)	31 3/4	(806)	
F	2	rails	hardwood	3/4	(19)	1 1/2	(38)	11 1/4	(285)	
G	2	rails	hardwood	3/4	(19)	1 1/2	(38)	10 1/2	(267)	
H	2	doors		3/4	(19)	10	(254)	30 1/2-high	(775)	stock can be wood-veneer pb or frame and panel hardwood



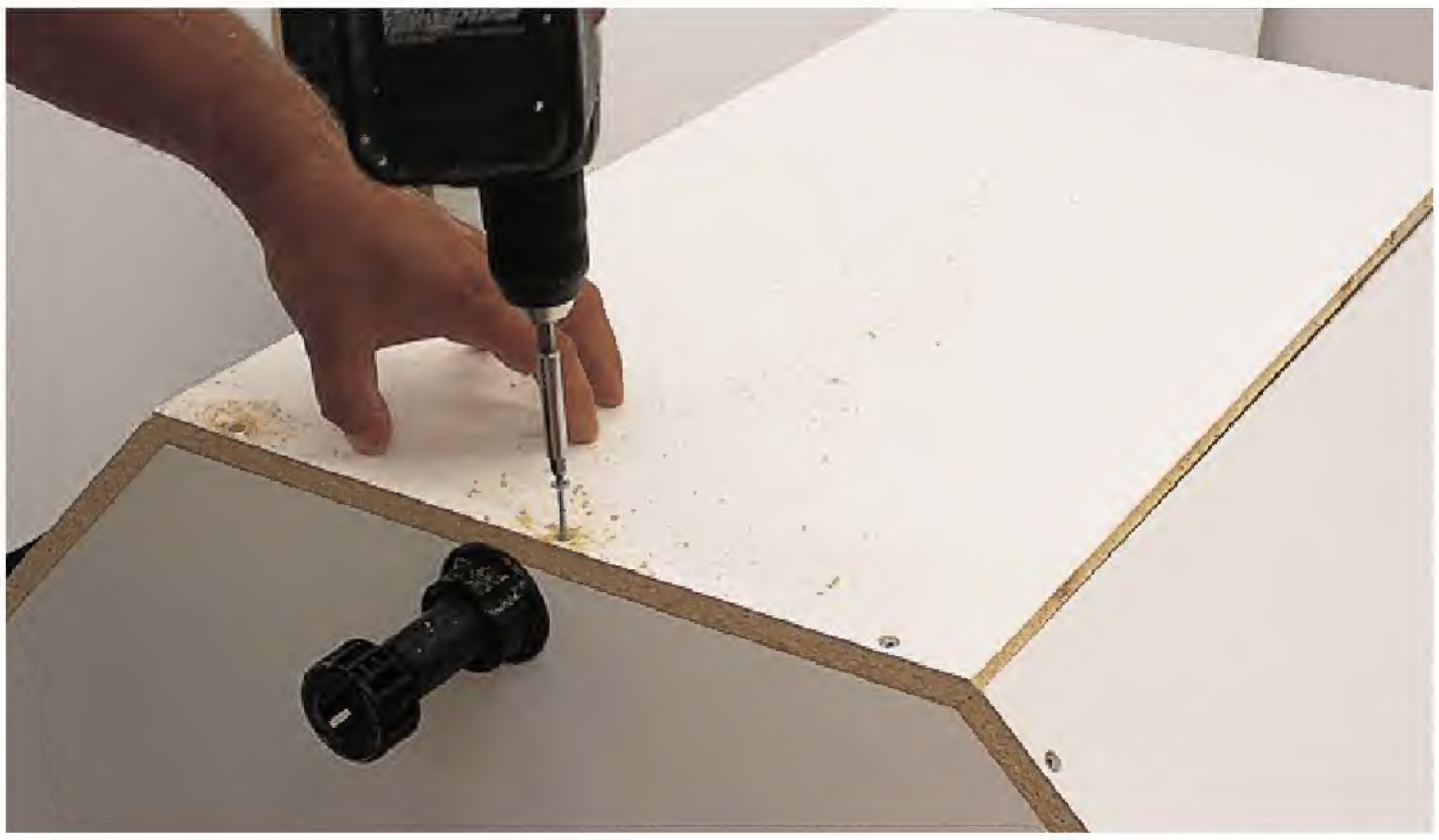
* Lazy Susan mounts in center of base and is supported on top by a cross brace attached by PB screws to the side ends.

1 The cabinet has six PB pieces as indicated in the drawing and in the cutting lists. Accurately cut the pieces as detailed. Do not cut the angles on the 18" × 31" backboard D at this time. I recommend that you cut it with straight cuts to the stated 18" × 31" size.

2 **RIGHT** Draw the front notch cutout lines and back angle cut line on the bottom B. Use a table saw to cut the two front notch lines, pushing the board in until the blade is about 3" away from the corner of the notch. The bottom of your blade will undercut farther into the board and will weaken the cutout. Follow the same procedures for the other line, running your blade into the board until it's 3" from the corner mark. Use a handsaw or jigsaw to complete the notch cutout. Next, guide the two front corners of the cutout section against the table saw fence with the fence set to a width of cut that will travel the blade along the angled back cut line. Be sure that your fence is long enough so that both cutout corners are tight against the fence for the full angled cut.

3 **LEFT** Install the cabinet legs in the positions as indicated in the drawing. Maintain the 3½" setback from the front edges of the cabinet. Remember that this setback is required for kickboard spacing on all the base cabinets. Position the other legs so they will extend out from the edge of the bottom board by ⅝" to aid in supporting the cabinet sides.

4 **RIGHT** Assemble the cabinet boards as shown, leaving the 18" × 31" backboard D until all others are secured. Use 2" PB screws in pilot holes, spaced every 8" on each panel. As well as securing the backs and sides to the bottom board, you'll also have to secure the backs to the sides with screws at each corner.



5 Measure the opening for the backboard D and fit it to the cabinet by cutting 45° angles on each side. It may be helpful the first time you build one of these cabinets to angle-cut the backboard so that it's a little larger, and trial fit the panel. Continue cutting the backboard slightly smaller after each trial fit until it's perfect.

Use 2" PB screws to attach the angled back to the bottom boards and backboards. Carefully site the screw line through the angled back and into the edge of the backs when drilling a pilot hole. It's a little difficult to drive screws at an angle, but take your time and drill the pilot hole accurately. Three screws on each side of the panel and two into the bottom board will hold it securely.

6 Cut and assemble the face frame as indicated, and install with the inside face of the sides flush to the inside surface of the face-frame stiles. Secure the frame to the carcass with glue and 2" finishing nails.

7 Install the angle clips, two per panel, so the countertop can be secured.

8 A board must be installed across the center of the cabinet to support the lazy Susan bearing assembly. This upper support is nothing more than a piece of ⅝"- or ¾"-thick melamine PB that's the same width as the baseboard. Secure it with two 2"-long screws through the cabinet side boards. If you have difficulty locating this board, wait until you're ready to install the lazy Susan upper bearing support and locate it directly over the bearing. This cabinet is now ready for the 32" lazy Susan and doors.

9 The door sizes on this cabinet are special. The 1"-plus rule doesn't apply here, so we use a calculation of rail width minus ½" for the doors. These two 10"-wide doors will have special hinges.

First, drill 35mm-diameter holes in one door, following the standard steps for hinge hole positioning. These cabinet doors require 170° hinges, but they cannot be installed with a ⅛"-thick spacer. The wide-opening hinge plates are properly aligned on the cabinet sides by temporarily installing standard 100° to 120° hinges on the doors. Follow the hinge and door mounting steps using the standard-opening hinge. Once the plates are properly located, switch the standard-opening hinges with the 170°-wide hinges. They will be attached to the hinge plates already mounted on the cabinet sides.

10 One of the two doors that have 35mm-diameter holes for the wide hinges will also need hinge holes drilled on the opposite edge of the door for bifold hinges. These special hinges join the two doors. The holes for the bifold-type hinges are drilled so the center of the 35mm hole is 12.5mm from the door's edge. That position will create a ¾ hole in the door, which is required for these hinges.

11 The installed doors require two 170°-opening hinges with standard mounting plates and two bifold-door hinges drilled as detailed in the previous step. Both hinge styles are adjustable, allowing you to accurately align these doors to the cabinet.

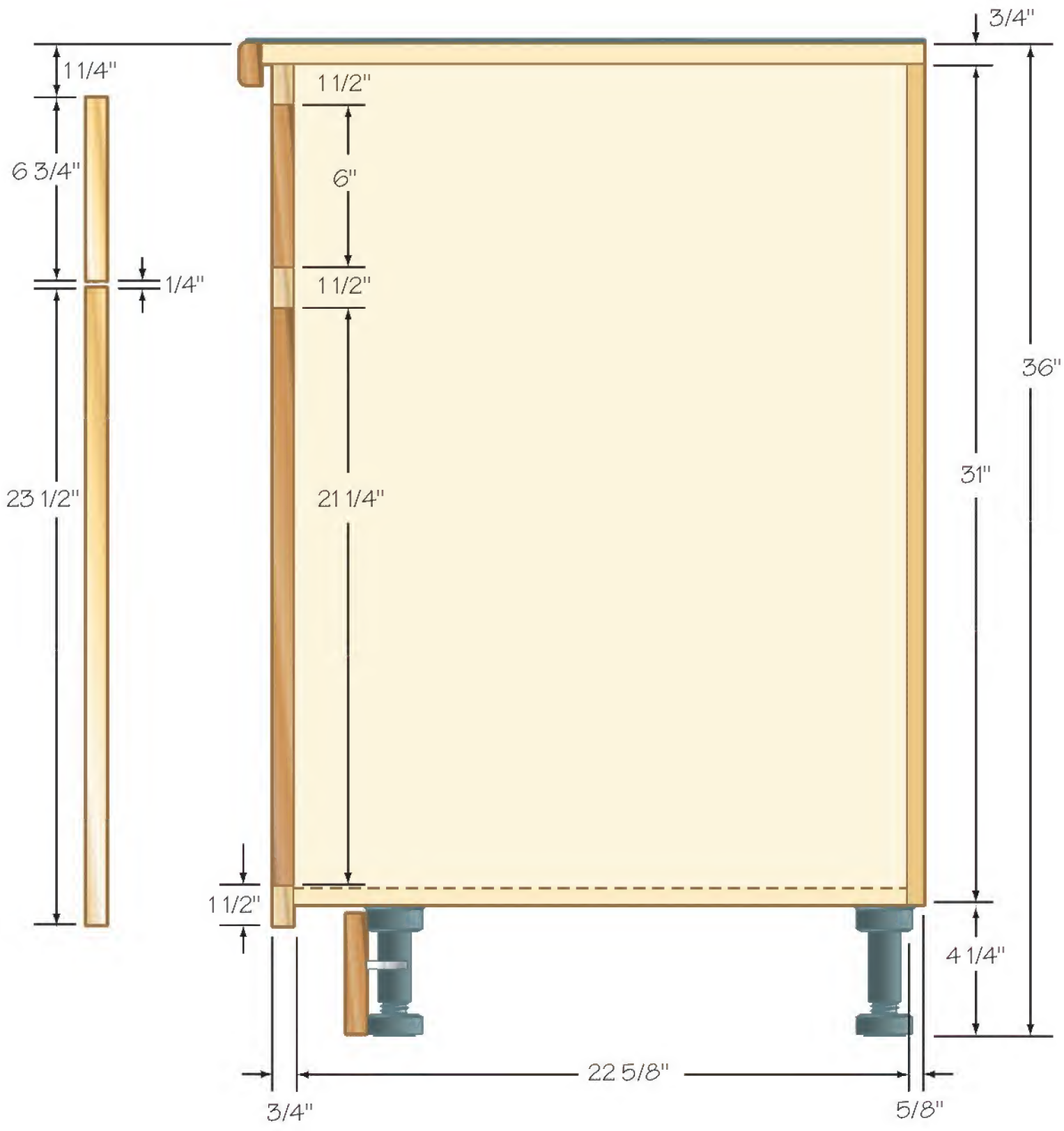
After installing the doors, follow the installation directions supplied with the lazy Susan assembly. Make sure it's properly positioned so the hinges don't bump against the revolving shelves or affect door operation. The cabinet is now ready to be installed.

Drawer Over Door Base Cabinet

The drawer-over-door base is a good way to gain extra drawer space. The cabinet shown in this illustration uses ⅝"-thick sheet material; however, ¾" stock can be used by following the cutting list on page 47 for standard base cabinet construction. In some kitchens many of the base cabinets are built in this style.

The large drawer in a 30" base unit is a useful addition to most kitchens. This cabinet style is also used when a counter cooktop is installed. In that circumstance, a false drawer front is permanently attached to hide the cooktop mechanism when the doors are opened. This cabinet style is also used for a sink cabinet, and the drawer face is often fitted with a flip-out kit and tray. The interior of the cabinet, behind the doors, can be fitted with either a pullout or an adjustable shelf.

DRAWER-OVER-DOOR BASE



Four-drawer Base Cabinet

The four-drawer base requires extra rails to fill the spaces between drawer faces. Just about every kitchen has at least one of the four-drawer base cabinets. They are primarily used as a cutlery center and are often located near the sink, stove or dishwasher. The cabinet is nothing more than a standard base unit fitted with extra rails to hide the gaps between the drawers. As shown in the drawing on the next page, there are spacing and rail position considerations so that the 30½" overall door, drawer/door or multiple-drawer height is maintained.

Construct the face frame using the dimensions as shown in the drawing on the next page. The five rails will divide the face frame into four drawer openings. The rails are 2" less in width than the outside face-frame dimension. Fasten each rail with glue and two 2" screws. Counterbore the screw holes so they can be filled with wood plugs if this cabinet is to be used as an end-of-run cabinet.

Using a 30" four-drawer base cabinet as an example, and standard ¾"-thick wood, this face frame would require two stiles 1" wide by 31¾" long and five rails 1½" wide by 28" long.

We don't have to be concerned about width as you can build any size drawer. You can use this cabinet to fill odd-size spaces in many situations. Apply the basic system design rule that inside face-frame width should equal inside carcass width, and make the cabinet any size you require. For example, if I had to fill a 26⅝" space, I would construct a face frame with 1"-wide stiles and rail widths of 24⅝". The carcass bottom board would be 24⅝" wide, equaling the inside face-frame width. Remember, you don't have to be concerned with sizes, because you can make the drawer faces any width as long as they are 1" wider than the inside stile-to-stile dimension. All other carcass boards follow the standard rules: sides are 31" high by 22⅝" wide (with ⅝" sheet material) or 22½" wide (with ¾"-thick sheet material). The bottom board is 2" narrower than the cabinet width, and the backboard is the total of the bottom board width and the two side thicknesses, by 31" high.

Drawer boxes, detailed on page 142, are 1" less in height and 1" narrower than the drawer opening. Most of the drawer glides that are installed need a ½" clearance on each side, and you should try to be as accurate as possible to achieve a proper fit.

Construction Notes

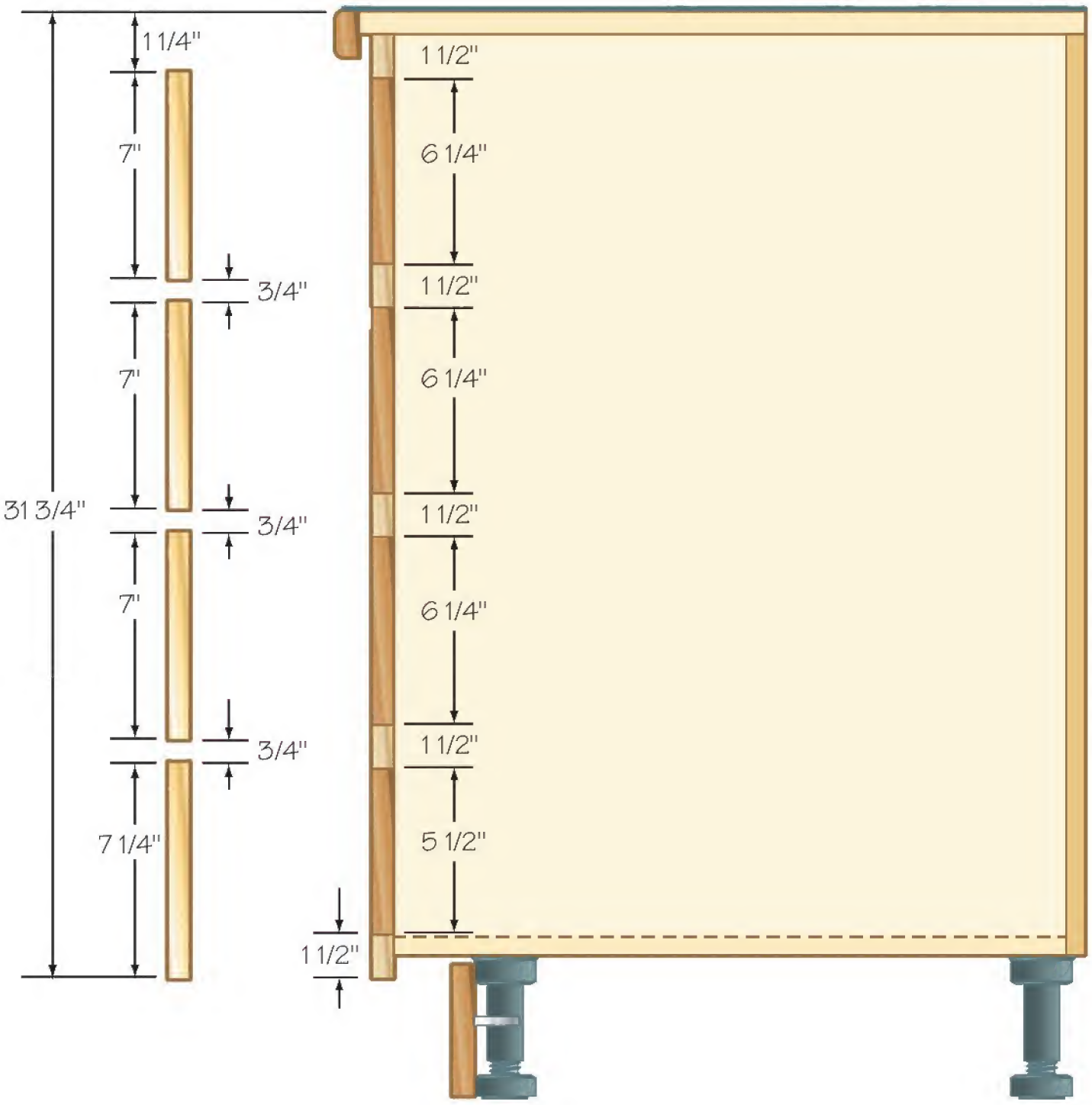
Construction procedures for the drawer-over-door base cabinet are identical to the standard base cabinet, with an added 1½"-high rail to cover the space between the door and drawer. The general design rule that applies is to maintain the 30½" overall height so that we have the 1¼" reveal at the top of the face frame. As previously discussed, our standard door height is 30½" for full-door cabinets. When we construct a drawer-over-door cabinet, or any other combination cabinet, we want to maintain that height so that all doors and drawers are at the same level. Maintaining this uniform line is visually pleasing, especially with base cabinets. The combination of a 23½"-high door and a 6¾"-high drawer face plus the ¼" space between them gives us the required 30½" height.

Drawer construction will be detailed on page 142 using the ⅝"- or ¾"-thick melamine PB box method, mounted on European bottom-mount drawer glides. Door installation is the same as with all other doors. If we use the 30" base cabinet as an example, we would require two doors 23½" high by 14½" wide. The drawer face would be 6¾" high by 29⅛" wide. The drawer face width is a combination of the widths of the two doors, plus a gap allowance between the two doors of ⅛".

In many of my kitchen projects, drawer faces are made from solid 1" × 8" hardwood. I decided on this method for a number of reasons, but primarily because 1" × 8" lumber is dressed to ¾" × 7¼", so you won't have to be concerned with edge-joining boards. This reduces the time and cost required to manufacture the cabinets. Cabinet door style will determine the amount of work necessary to produce a compatible drawer face. In most cases I use a router to form a roundover or cove detail to the drawer edge. This method will produce a drawer face for almost all of your applications.

Occasionally you may want a fancy and intricate drawer face. In those instances you can order or make a face to match your door style. However, the cost per drawer face increases and you may want to compare the costs, particularly if you have quite a few drawers in your kitchen.

FOUR-DRAWER BASE CABINET



Reduced- or Increased-Depth Base Cabinets

You may, on occasion, require base cabinets that are not standard 24"-deep units. One situation may be where you want a shallow cabinet base run for storage against a wall in a passageway. Or, on the other hand, you might want deeper cabinets for an island.

The easiest solution for a shallow version is to convert the standard upper cabinets into base cabinets by attaching adjustable legs. Sides and bottom boards can be cut wider for deeper cabinets without changing the dimensions of the backboard or face-frame members. As you may have already noticed, the overall cabinet height and door height are the same for the upper and base cabinets; only the depth is changed. You can purchase or build many different countertop sizes to accommodate these special base cabinets.

I have, on many occasions, used reduced-depth cabinets in a kitchen island situation. Space is sometimes a problem when designing islands, so I've often reduced the base units to a maximum of 18" deep and installed a 32"-wide island countertop. This allows the countertop to overhang the base cabinets by approximately 13", taking into account the door width and door side overhang. Stools can be used to provide a casual eating area, or as a place to sit while you're preparing food. The cabinet style in this system can be easily altered to meet any requirements.

Sink Base Cabinets

Sink bases are standard drawer-over-door base cabinets, usually a 36" base, with a false drawer face or drawer face flip-out over the doors. The drawer face covers the bottom of the sink when the doors are open. I have built full-door sink bases to keep the cost down; however, my preference is a false drawer-over-door cabinet.

Install six legs on this cabinet, one at each corner as detailed earlier in this chapter, and one at the front and back in the middle of the base, to give it added support. This cabinet usually takes quite a bit of abuse because the supply and drain plumbing pipes must be installed. It's not uncommon to have someone crawling inside the cabinet to install and connect the service. It is also possible that you may have to relocate a cabinet leg if it ends up in the path of a plumbing pipe.

You may have to modify a shelf after you determine the location of the pipes inside the cabinet. Leave it until the installation is complete to determine where, if possible, you will be able to install the shelf. In many cases, shelf installation is not possible or practical because of the plumbing pipes.

specialty cabinetry

No matter how many times essentially the same cabinets are made (for a kitchen, den or recreation room) there will always be special needs that arise at some place. Whether it's for a pantry or microwave in the kitchen, computer desk, or DVD storage, specialty needs arise. This chapter aims at addressing some of these speciatly needs, but we know there are lots more out there.

Microwave and pantry cabinets are simply an upper cabinet and a lower cabinet with the space between them connected. Install these cabinets before or at the same time as the base cabinets so your maximum cabinet height is defined. This uniformity of height is important for upper cabinet trim installation, as well as visual appearance. Since these cabinets are often end-of-run units, finishing trim should be applied.

Don't let the size or apparent complexity of these cabinets bother you. They are simple to build although somewhat awkward to handle alone. You will probably need someone's assistance during the assembly stage.

The backboards of these cabinets, like all the other standard units, will be installed over the side edges, which reveals the backboard edge at the side of the cabinet. These visible edges will be trimmed with doorstop moulding to finish the cabinet after installation.

Finally, visualize these tall cabinets as uppers and lowers with common full-height sides. Cut the horizontal shelves to the width you require for a microwave, built-in oven or any other special application. If you keep the general principle of face-frame height at ¾" longer than the cabinet sides, you can easily design and construct any tall cabinet.

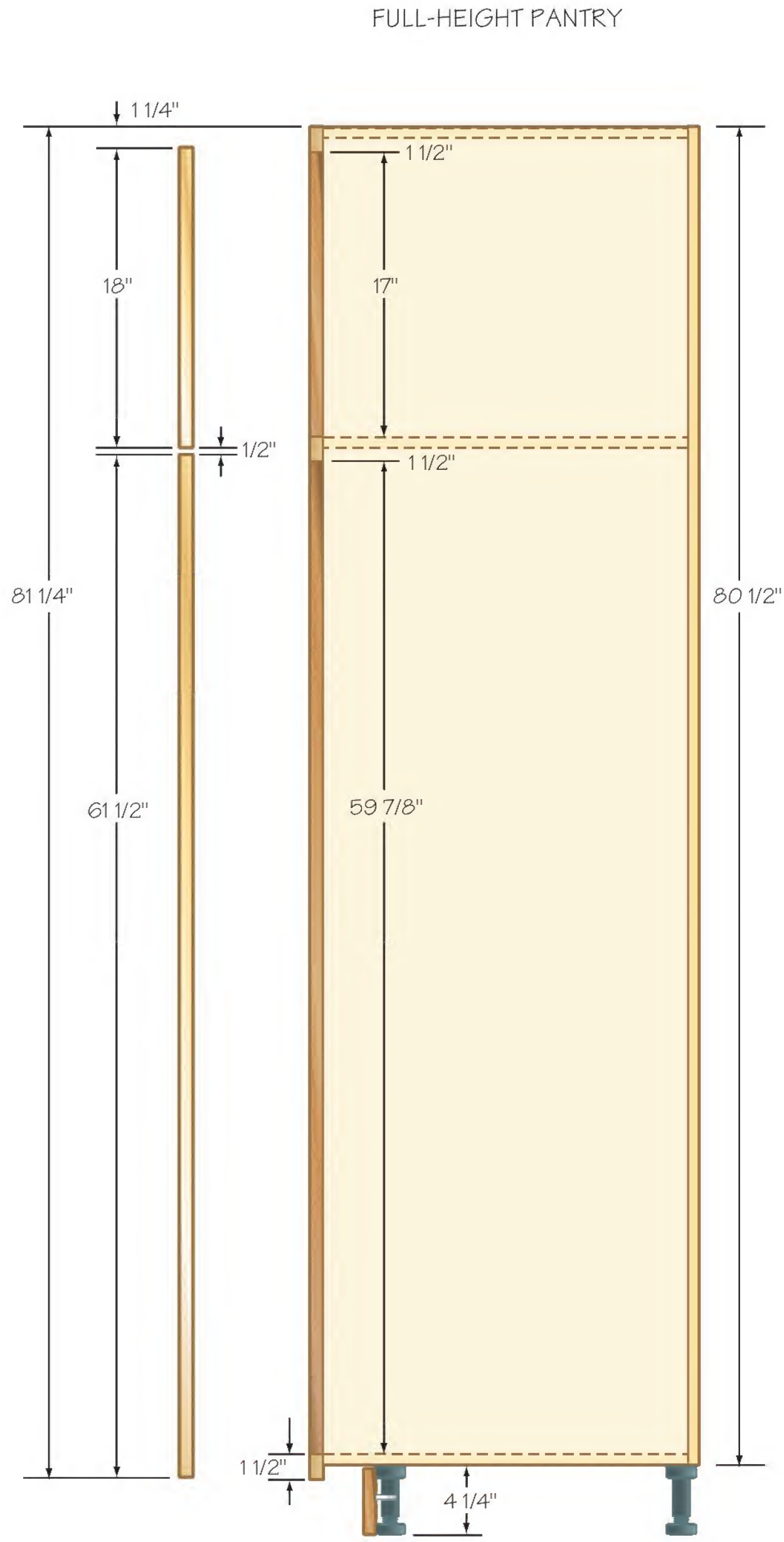
Pantry Cabinet

A pantry cabinet is simply an extended base cabinet with horizontal dividers.

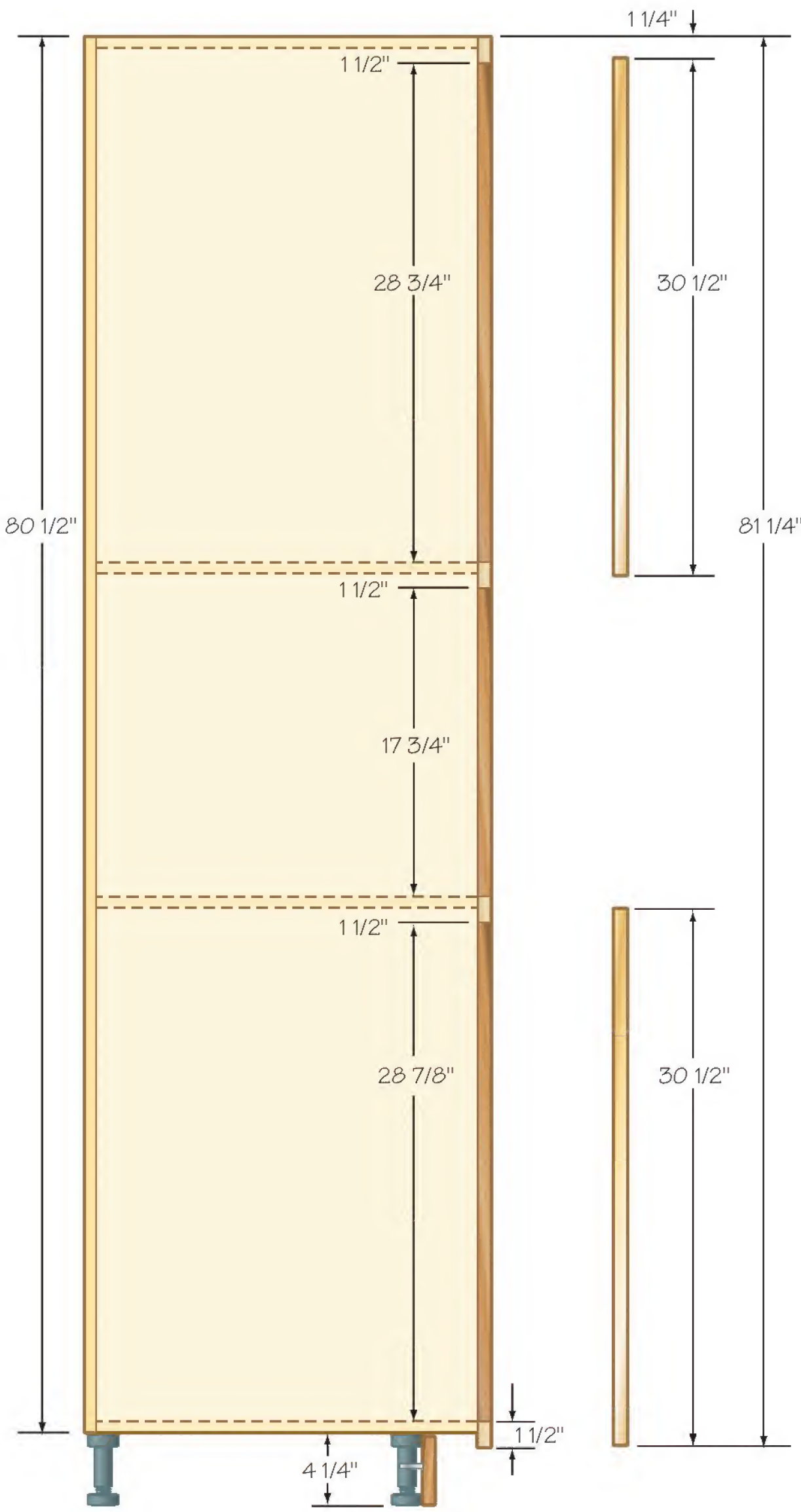
Pantry and microwave cabinets share the same basic carcass assembly. The sides are 80½" high and as deep as you require; the top and bottom shelves follow the width rules for standard cabinets; and the backboard is also 80½" high and as wide as the bottom board plus the two side thicknesses. It may have one or two additional fixed shelves, depending on the style of the cabinet. The face frame is 81¼" high, following the rule that face frames are ¾" longer than cabinet sides, with 1"-wide stiles and 1½"-wide top and bottom rails. The face frame may also contain up to five additional rails depending on the drawer and door combination. Each cabinet is normally fitted with adjustable shelves, drawers, pullouts or a combination of all three.

The upper section of the pantry cabinet is high and sometimes very deep. The tendency is to store kitchen utensils that are not often used for day-to-day meal preparation. To better use this space, you might consider installing vertical fixed partitions in place of the normal horizontal adjustable shelf. Vertical partitions allow you to store articles such as cutting boards, pizza trays and large serving platters that usually end up stacked on top of one another in a base cabinet. Simply attach the verticals with two screws through the top of the cabinet and two through the underside of the fixed shelf. You don't have to be concerned with shelf-loading capacity, as these verticals simply define cubicles for large item storage. Use ⅝"- or ¾"-thick melamine-coated PB as the divider partitions, with plastic edge moulding, veneer tape or hardwood edging covering the cut end.

The drawing shown here details the construction of a pantry cabinet in which you install adjustable shelves or pullouts. The pantry cabinet is built using two doors, with the lower, larger door having three European hinges installed. The lower door is usually 61½" high and the upper door is 18" high. A ½" gap is left between the upper and lower door so that we maintain the 1¼" space at the top of the face frame. A rail is installed, with a fixed shelf board, at the point where the upper and lower doors meet.



FULL-HEIGHT MICROWAVE CABINET



Microwave Cabinet

This cabinet is a combination base and upper cabinet with a fixed shelf compartment for the microwave oven.

Microwave cabinets, as shown in the drawing, follow all the standard cabinet construction principles and usually contain a lower drawer bank or pullouts behind doors, with adjustable shelves behind the upper doors. The middle opening normally contains the microwave. The opening space is large enough for most microwaves using a standard cabinet width of 27", which has a 25" inside face-frame width. When planning for a microwave cabinet as part of the renovation project, don't forget to have an electrician wire an outlet in the space where the microwave is to be installed.

If you are going to install four drawers in the base of this cabinet, follow the same rules and dimensions that apply to a four-drawer base cabinet. Remember to use spacing cleats if you are installing pullouts behind the doors on either cabinet. The upper sections of these cabinets are normally fitted with adjustable shelves.

The microwave cabinet carcass can be built using wood-veneer-covered particleboard, as a portion of the cabinet interior is visible. A ⅝"- or ¾"-thick wood-veneer board will allow the face frame to extend beyond the carcass, which makes it easy to use the wood doorstop moulding around the perimeter that is visible. This technique covers screws and softens the look of these large cabinets. Check the moulding thickness before cutting your tall cabinet stiles.

Finishing End Cabinets

Base and upper cabinets that are at the end of a run, and open to view on one side, must be finished so the melamine PB sides can't be seen. Identify these cabinets in the planning stage.

To allow for the finishing trim that's used on end-of-run cabinets, increase the stile width by ¼" for ⅝" material or ⅜" for ¾" material on the side to be finished. This stile width increase technique is needed for end finishing, contour fitting of the cabinet to a wall or custom cabinet fitting of a cabinet run that is closed by walls on both ends. In the planning stage I normally label a cabinet that requires increased stile width with a measurement and side designation. For example, a 30" cabinet that will be used as a left-side end-of-run cabinet will be shown on my plan as a "30" plus ¼" L" upper or base.

Standard stile width is 1", and standard side thickness can be either ⅝" or ¾". This means, on a normal cabinet, the stile extends beyond the side by ⅜" with ⅝" material, and ¼" when using ¾"-thick sheet stock. The ¼" or ⅜" increase in stile width makes the stile extend a total of ⅝" past the side.

After cabinet installation I install ¼"-thick veneer plywood to match the doors, and wood doorstop moulding, which is slightly thicker than ¼", around the perimeter of the cabinet end.

Construction Tip

Apply ¼" veneer-covered plywood with construction cement and brad nails to the exposed end of the cabinet. On base cabinets I add a ¾" filler to the bottom of the cabinet side to extend it to 31¾", so the applied veneer panel will be flush with the bottom of the face frame.

The screw holes that secure the end-of-run cabinet stile to the cabinet rails must be filled with wood plugs so they won't be visible. I use a ⅛" countersink drill bit assembly with a ⅜" counterbore hole for these screws. I fill the holes with ⅜" wood plugs sanded flush to finish the visible stile sides.

Refrigerator Surround Cabinets

Refrigerator surround cabinets are a modified version of the 33" over-the-fridge cabinet. Extend the sides and stiles to meet your overall height requirement, normally the same height as the top of your upper cabinet position, using wood-veneer PB and hardwood stiles. I extend the stile on the panel side from the floor to the top of the cabinet. The depth of an over-the-fridge cabinet must be increased to fully enclose the fridge. The cabinet width should also be increased to maintain the inside clearance for the fridge. In most cases, you can use the normal 1"-wide stiles, but verify that you'll have enough outside overhang to hide the edges of the perimeter trim moulding you plan to use.

Modify how you fasten the top and bottom boards with the use of screws and brackets. If you plan to use wood doorstop moulding as a perimeter trim, place the screws that support the bottom and top boards in areas where they will be hidden by the trim. Reduce the depth of the top and bottom boards by ⅝" so the backboard is set inside and flush with the back edges of the sides in the rear of the cabinet.

Refrigerator Panels

Many modern refrigerators will accept either ¼"-thick veneer plywood panels or raised solid-wood panels. The appliance has a mounting kit or the option can be purchased.

These panels are the same as the center section of your cabinet doors. They can be finished to match the doors and add a built-in, custom look to your kitchen project. The wood panel feature is also available with some dishwashers. The installation of appliance panels is quick and easy using the manufacturer's kits.

Custom Stoves and Range Hoods

Slide-in stoves and custom range hoods are very popular. The stove fits tightly into a measured space between cabinets and a countertop that has been cut to an exact size. The manufacturer will provide you with the cabinet-to-cabinet measurement for the slide-in stove.

Typically, the countertop is installed over the space and a notch is cut to accept the stove. The cutout dimensions are exact, and in my experience of installing these slide-in stoves, there's no room for error. The stovetop has a small lip that overlaps the countertop, but it's often only ⅛" to ¼", so accurate cutting of the countertop is important.

Custom range hoods are available in many styles, including slim-line, low-profile and slide-out models. Another option is a combination range hood and microwave. They are normally 30" wide, but often require specific clearances above the stove elements and special mounting procedures.

Microwave Cabinets

Space is often an issue, and getting the microwave off the countertop can free up valuable working areas. But a tall microwave cabinet isn't always a practical option for your new kitchen.

Microwaves can be installed under upper cabinets, and placed at the same level as the bottom of standard-height cabinets by building a reduced-height upper. I normally build a box that's open on the front and back to hold the appliance. The bottom board of the box is sometimes extended for large ovens.

I use solid wood that matches the doors and face frames. The box is attached to the underside of a reduced-height upper with screws or nuts and bolts. The back of the box is purposely left open to accommodate the electrical plug installed for the oven.

Display Shelves

Display shelving for collectibles is often part of a kitchen project. Many people have favorite items to display, and open kitchen shelving is the perfect spot. There's always an extra 6" or 8" of wall space that's too small for a cabinet, but ideally suited for an open shelf.

These open shelves serve many useful purposes; they add visual interest to your cabinetry, provide a display area and allow the cabinetmaker to custom fit a complete run of cabinets on any wall. The shelves can be made to fit any space.

Normally I use solid wood for these display shelves. I've built half-round shelves, angled units and simple, straight, open shelving between cabinets for books. Your imagination is the only limiting factor with these display cabinets.

Kitchen Work Centers

Desks and writing areas are often needed in the modern kitchen. Computers are often a part of the equipment in today's kitchens and require a work area.

Desktops are 30" high and made using standard cabinets that have been modified. Use reduced-height base units, including drawer banks, and attach any style of countertop. The wood-edged top detailed on page 113 is perfect for this application.

Use the rule of 12s when calculating seating height for these work areas: The chair or stool should be 12" lower than the work surface for maximum comfort.

Sink Flip-Outs

Sink cabinets, normally a 36" standard base, are not usually fitted with 30½" full cabinet-height doors. They are built as a drawer-over-door cabinet so that the underside of the sink is not visible when the cabinet doors are open.

Because the sink occupies the space needed for the drawer carcass, the drawer is a false face and nonoperational. Normally this space is lost. But various suppliers, such as Rev-A-Shelf, sell a flip-out kit that includes hinges and a plastic tray. You can install this kit on the false drawer front and have a functional flip-out drawer face with a plastic tray inside, used to store scrubbing pads and dish soap. Your local kitchen hardware supply outlet should stock these kits.

Construction Tip

The possibilities available to the woodworker to design and build kitchen accessories are unlimited. I've seen pegboard, mounted on 1" dowels, installed on the inside of cabinet doors for storing pot lids. A unique spice rack made with 1×4 wood at either end, and ½" dowels spaced 1" on center to hold spice bottles in a drawer. And base pullouts of every shape and size to accommodate special needs.

I suggest you look through magazines and browse the accessories section of the home building supply centers, where you'll find many items that can be built inexpensively in your workshop.

Built-in Closet Cabinetry

While a closet project may stretch the term "cabinetry", the same construction process is used. And let's face it, upgrading a closet is a great use of cabinet-making skills, and an excellent definition of "specialty" cabinetry.

In this project, I'll try to provide you with a few ideas that will help improve storage in your closets. Detailing exact measurements would be of little value as everyone's closet is different, but I'll attempt to show you how to add valuable space and organization to any closet.

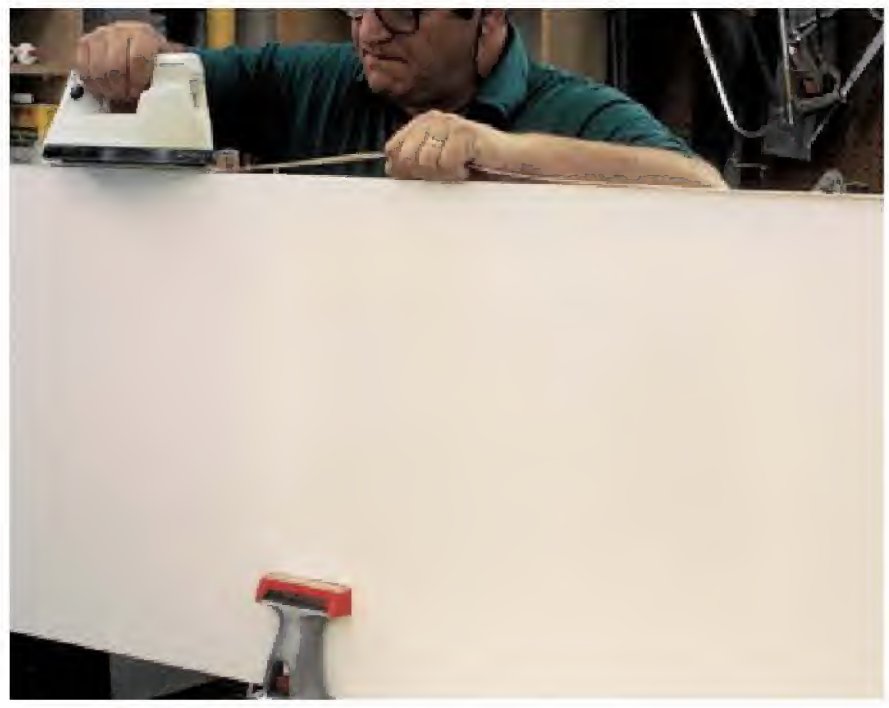
Each closet is unique, but the construction steps used to build towers, drawers, adjustable shelves, and support and divider panels are the same for any closet space; (and again, it's still cabinetry) only the sizes are different. The closet I converted is common to many homes that have been built in the last thirty years. Home builders create this style of closet by installing sliding doors across the width of a room. Most are 2' deep with floor-to-ceiling doors, or with doors attached to a drywall-covered header, which ride in a track. They may have three or four doors, depending on the room width. These closets waste a great deal of space but are quick and easy to install for the builders.

The interior is normally at the full room height of 8'. Often, the closet has one divider, or center panel, and a rod on each side to hang clothes. The key to improved closet organization is a drawer tower or towers, depending on closet width, with all the other racks, rods and panels attached.

Building a Drawer/Shelf Tower

The center tower with drawers and shelves shown in the photo above is the core module with most closet systems. We want to use the valuable space that often goes unused above and below the hanging rod. The example tower shown is only 18" wide, but it creates a tremendous amount of increased storage space for sweaters and other garments.

All other shelves and clothing racks are fixed to the side of this tower and a wall.



1 I used white melamine-coated particleboard (PB) for this project. It's virtually maintenance free and is prefinished. Two sides are cut at ⅝" × 23" × 86" long and white heat-activated melamine edge tape is applied to the front edges.

Shop Tip

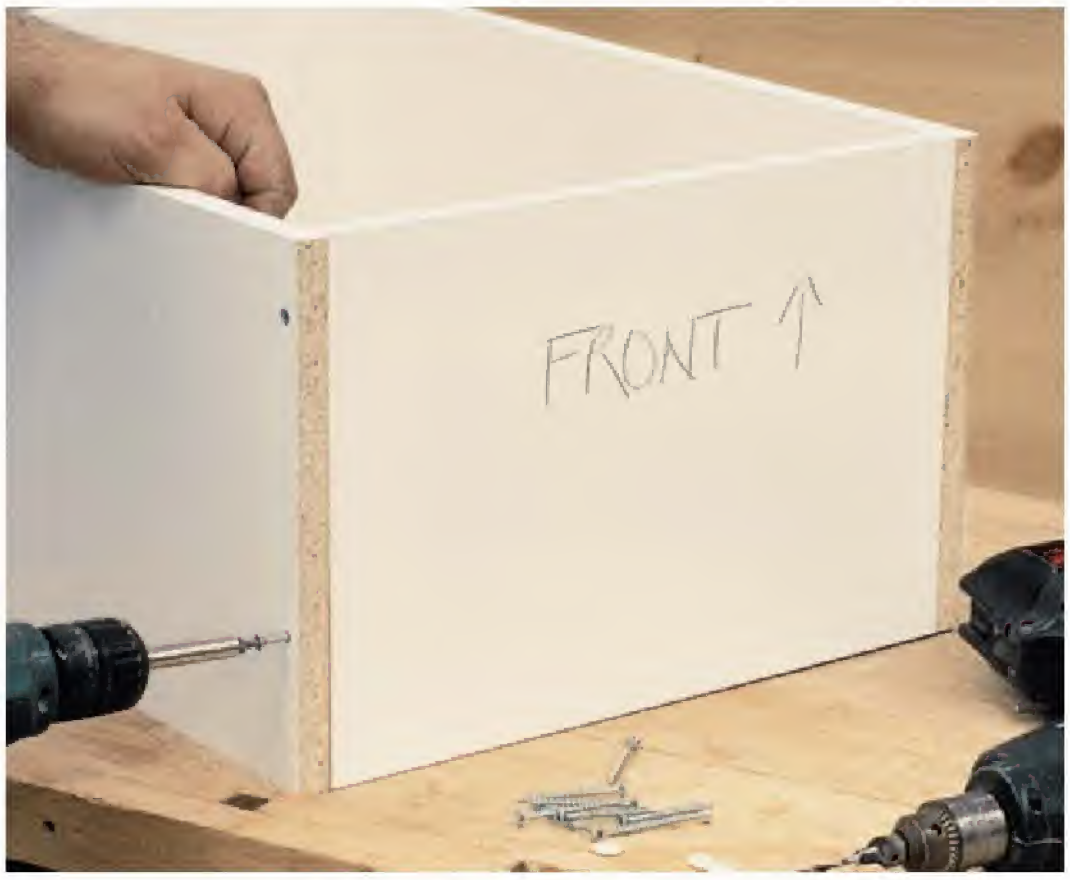
Drive screws so the heads are flush to the surface. Use white screw cover caps or stick-on white cover dots that are available at the home center to hide the screw.

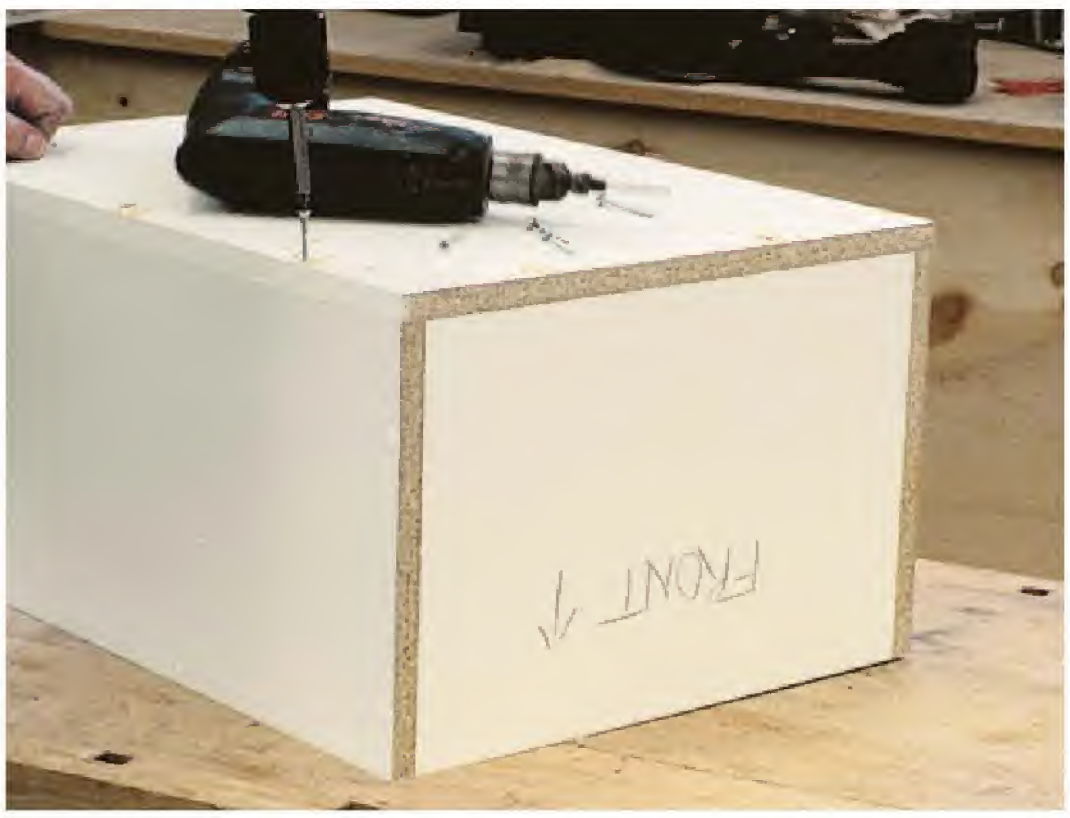
2 The top, bottom and fixed section divider boards are ⅝" x 16¾" wide x 23" deep. Apply edge tape and use three 2" screws per side on each support. The screws should be designed to join PB. Remember to predrill the screw holes and drive them in until the head is flush with the outside surface. The lowest support is 2⅜" up from the bottom, the middle support is at 51", and the top support is flush with the top edge of the tower sides.

3 The toe kickboard is ⅝" thick × 2⅜" high × 16¾" long. It's secured with one screw on each side and two through the top of the bottom shelf. Set the kickboard 2" back from the front edge.

4 Two backboards, one at ⅝" × 16¾" wide × 33⅝" high and the other at ⅝" × 3" high × 16¾" wide, are attached to strengthen the cabinet. Use 2" screws driven through the side panels and cover caps to secure the boards.

5 The tower will be anchored to the wall with 3" screws through these backboards. Full-height backboards are required on any open shelf section. Drawer compartments need only a small fixing cleat that can be used to secure the cabinet to the wall. That completes the case construction for the tower.





7 Install the bottom with 2" screws approximately 6" apart.

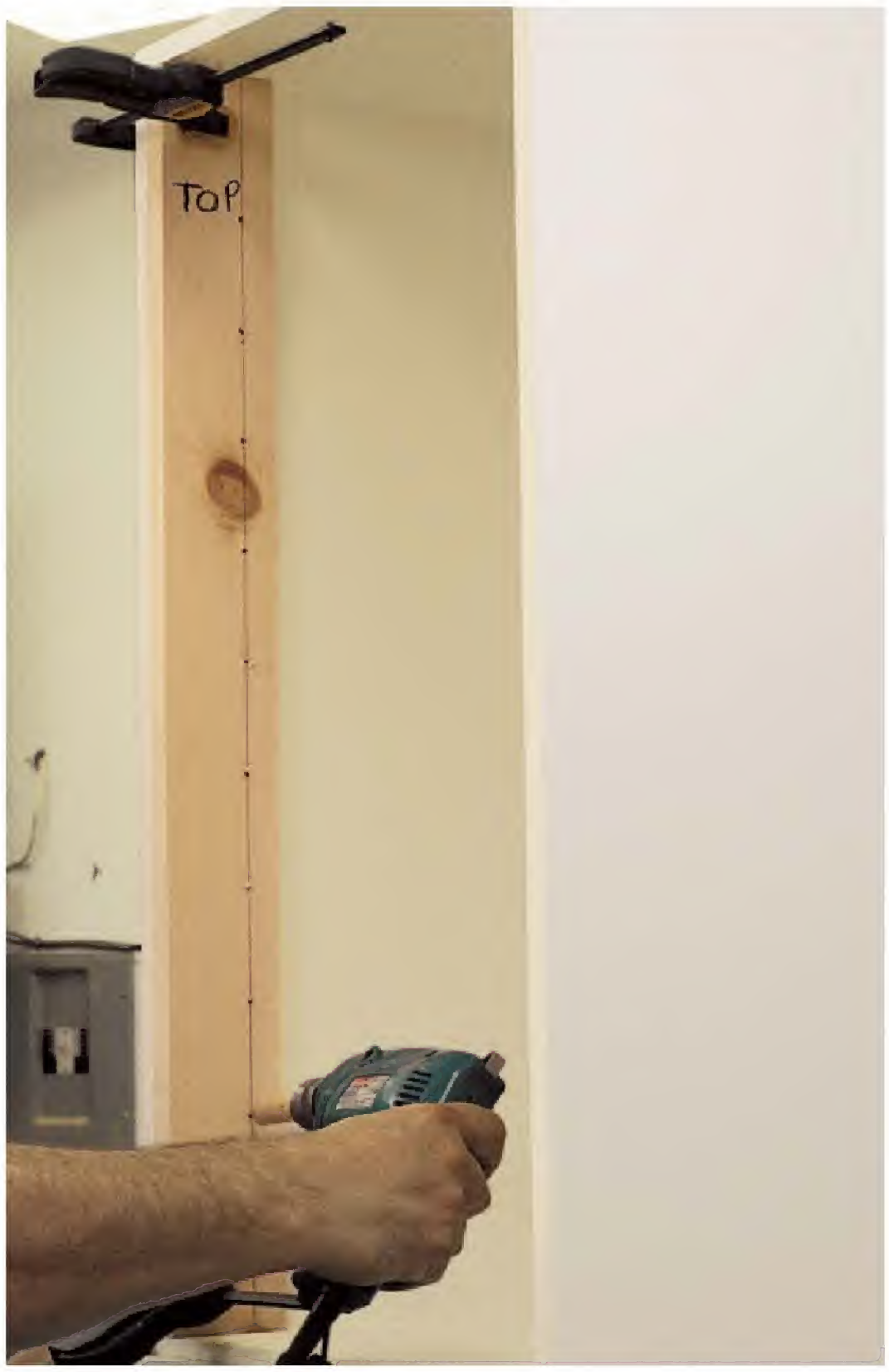
6 These sample drawers are sized to fit an 18"-wide tower using ⅝" thick material with an inside width of 16¾". You'll need the following ⅝"-thick panels to build four drawers:

- 8 sides @ 10" high x 22" deep
- 8 backs & fronts @ 10" high x 14½" wide
- 4 bottoms @ 15¾" wide x 22" long
- 4 drawer fronts @ 12⅛" high x 18" wide

Apply edge tape to the exposed edges, which are the tops of the sides, backs and fronts, as well as the side edges of the bottoms. Attach the sides to the backs and fronts with 2" screws. This is a common screw butt joint using ⅝"- or ¾"-thick melamine-covered particleboard.

8 Install a set of 22" bottom-mount drawer glides on each box. Start by installing the runners on the box, then attach the cabinet runners with 12" spacing. I made my drawer box 1" narrower than the inside tower width, according to the specifications with the Blum glides I'm using. However, don't assume this dimension is standard with all manufacturers. Purchase the drawer glides before beginning construction to determine the required clearance.

9 Secure the drawer front to the drawer box with two 1" screws by driving them through the drawer box and into the back of the drawer face. Mount the bottom drawer first as shown, covering the bottom board's edge. Continue attaching the drawer fronts from bottom to top, leaving a 1/16" space between them.



10 The shelves will be sitting on adjustable pins. Make a drill template from scrap wood, spacing the guide holes 2" or 3" apart. Use the template as shown to drill holes in the upper section of the drawer tower.

11 Cut the number of shelves you require at ⅝" × 16 11⁄16" wide × 22¼" deep. Notice that the shelves are slightly narrower than the cabinet's interior so they can be easily adjusted. Cover the front edge with iron-on edge tape or a ⅝" plastic cap moulding that's secured with construction adhesive. Plastic cap molding is a common shelf edge material that's available at all home centers. It's more durable than iron-on edge tape and an ideal covering for shelf edges that tend to get bumped as items are taken on and off the shelves.

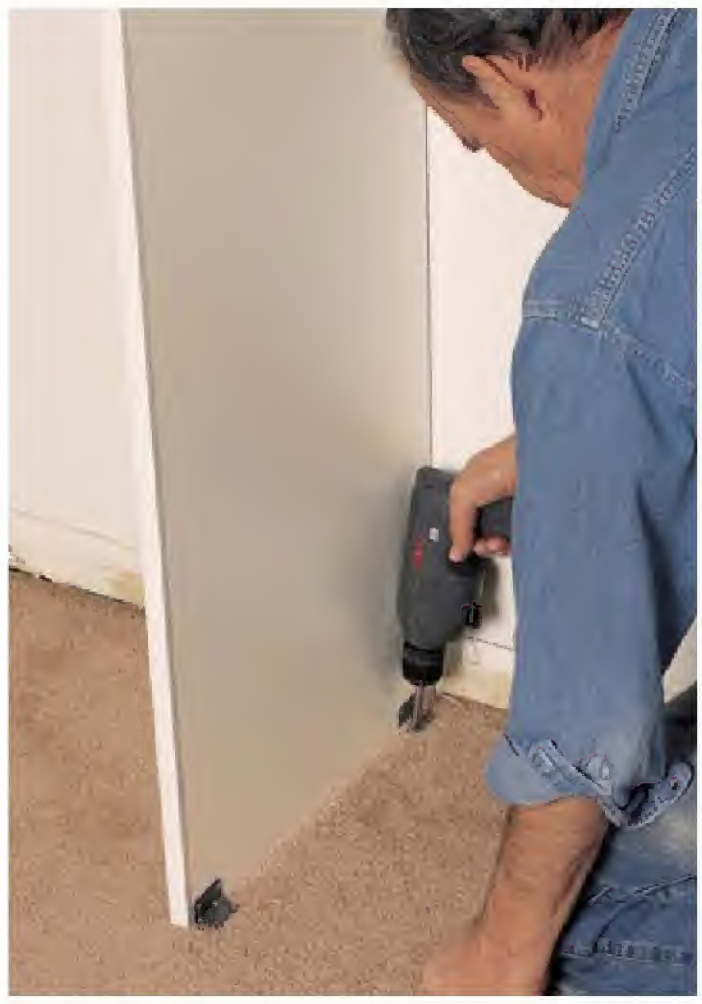
Shop Tip

Make a drill stop using a piece of wood dowel rod. Set it to the template's thickness plus the depth required for the shelf pins you are using, for perfectly drilled holes. More importantly, the stop prevents the drill from being pushed through the cabinet side.

The lead photograph shows another tower in this completed project. This narrow tower, a simple tall cabinet with a melamine door, is a special-application storage tower for tall narrow items and isn't commonly used in most closet systems. Normally, a divider panel is installed to support an additional shelf system for shoes, as well as the hanging rods.

Towers with doors are built following the same construction steps. The door normally covers the top and bottom board edges and is attached with hidden hinges. Doors are 1" wider than the cabinet's inside dimension.

12 Start the closet installation with the drawer tower. Verify that it's level and plumb. Anchor the tower to the wall, through the backboards and into the studs if possible, with 3" screws.



13 You can install any number of divider panels in the closet system. Secure these panels in place with right-angle brackets attached to the floor, ceiling and back wall.

14 I have added an additional column of shelves between an installed divider panel and the tower side. Use the shelf hole jig and procedures described earlier for the adjustable shelf pins. These extra shelves can be any width, depending on where the divider panel is installed.

15 Commercially available hanging rods can be purchased at all home stores. These can be adjusted to any width and are attached to the walls and divider panels with screws. I suggest you make square blocks of melamine PB to mount the rods so that you can use longer screws for added support.

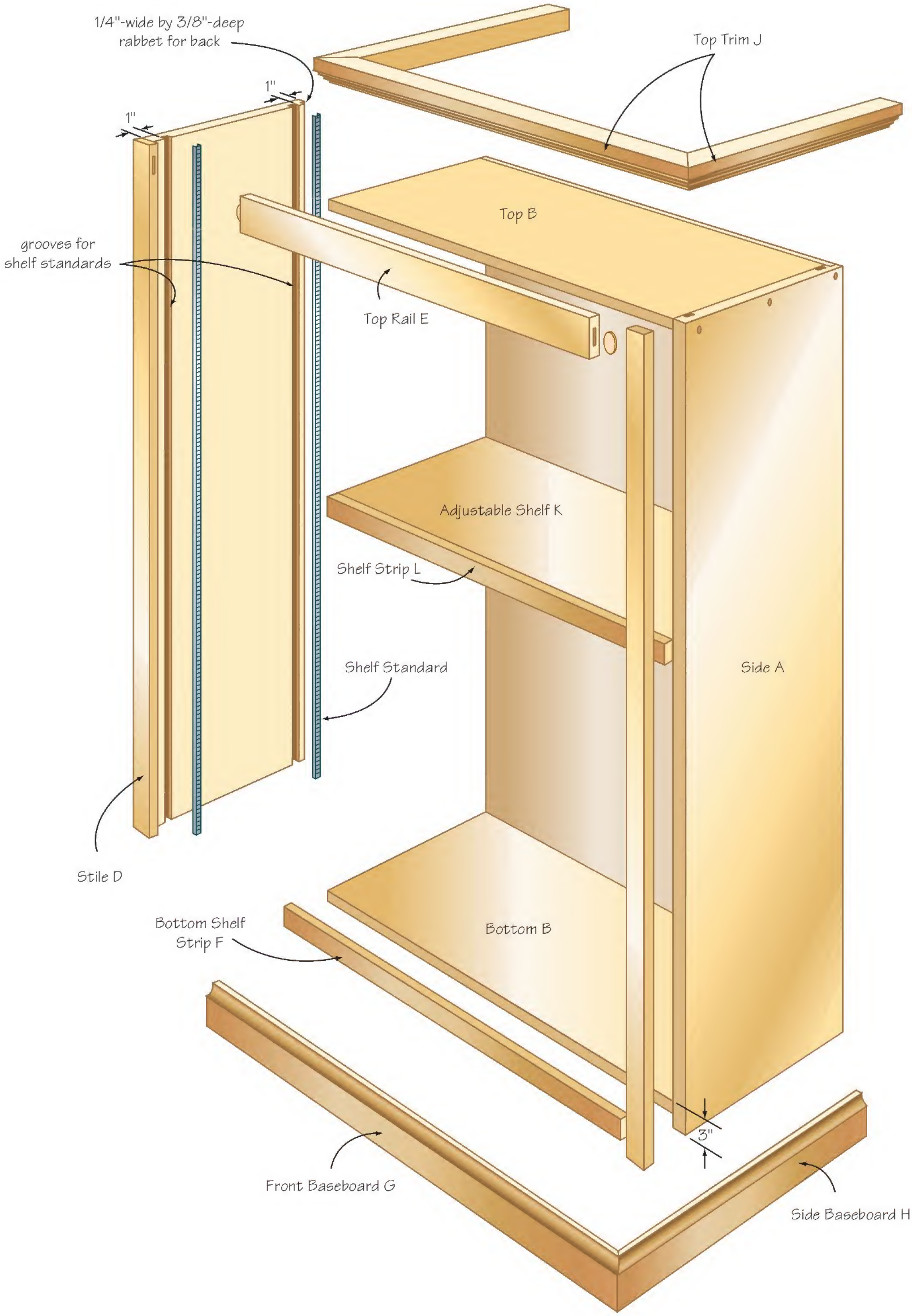
Basic Bookcases

Another type of specialty cabinetry is shelving. Again, built using the same techniques, shelves and bookcases can be made in a variety of heights and widths and attached together in series to create an entire wall of storage.

I made this project using oak veneer plywood and solid woods. The shelves are all adjustable, and I've used a little different technique for the supports in place of the usual holes. These metal shelf standards are installed in a groove, are capable of handling heavy loads and are available in a number of finishes. I used white so it would be easier to see in the photographs; however, gold might be more suitable with the natural clear polyurethane that I've applied. One note: Purchase your shelf standards before cutting the grooves. There are size variations depending on the manufacturer, and you want to be sure the cut is correct.

1 Each side (A) requires a rabbet on the rear inside face that's ⅜" wide × ¼" deep. They also need two grooves 1" in from the edges, for the shelf standards.

2 The shelf standards should be cut 78" long. Install them in the grooves and use the small nails provided to secure the standards.


1/4"-wide by 3/8"-deep
rabbet for back
1"
1"
Top Trim J
Top B
grooves for
shelf standards
Top Rail E
Adjustable Shelf K
Shelf Strip L
Shelf Standard
Side A
Stile D
Bottom Shelf
Strip F
Bottom B
3"
Front Baseboard G
Side Baseboard H

CUTTING LIST FOR FOR BASIC BOOKCASE
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	veneer ply	3/4	(19)	11 7/8	(301)	78	(1981)	
B	2	top & bottom	veneer ply	3/4	(19)	11 7/8	(301)	31 3/4	(806)	
C	1	back	veneer ply	1/4	(6)	32 1/2	(826)	75 3/4	(1924)	
D	2	stiles	hardwood	3/4	(19)	1 1/2	(38)	78	(1981)	
E	1	top rail	hardwood	3/4	(19)	3 1/2	(89)	30 1/4	(768)	
F	1	bott. shelf strip	hardwood	3/4	(19)	1 1/2	(38)	30 1/4	(768)	
G	1	front baseboard	hardwood	3/4	(19)	3	(76)	34 3/4	(883)	angle cut on both ends
H	2	side baseboards	hardwood	3/4	(19)	3	(76)	13 1/2	(343)	angle cut on front end
J		top trim	hardwood	approx. 7' in length						depends on style chosen
K	4	shelves	veneer ply	3/4	(19)	10 7/8	(370)	31 1/2	(800)	
L	4	shelf strips	hardwood	3/4	(19)	1 1/2	(38)	31 1/2	(800)	

3 Attach the two sides to the top board with glue and 2" screws (it should be flush with the upper ends of the sides). Drive the screws through the outside face on the side panels, as they will be covered with trim. Attach the bottom board in the same way, aligning its top surface 3" above the bottom ends of the sides. The top and bottom boards should be flush with the side boards' front edges.

4 Use glue and brad nails to attach the backboard. Take a little extra time to cut the back accurately because a squarely-cut back will properly align the bookcase carcass.

Special Details

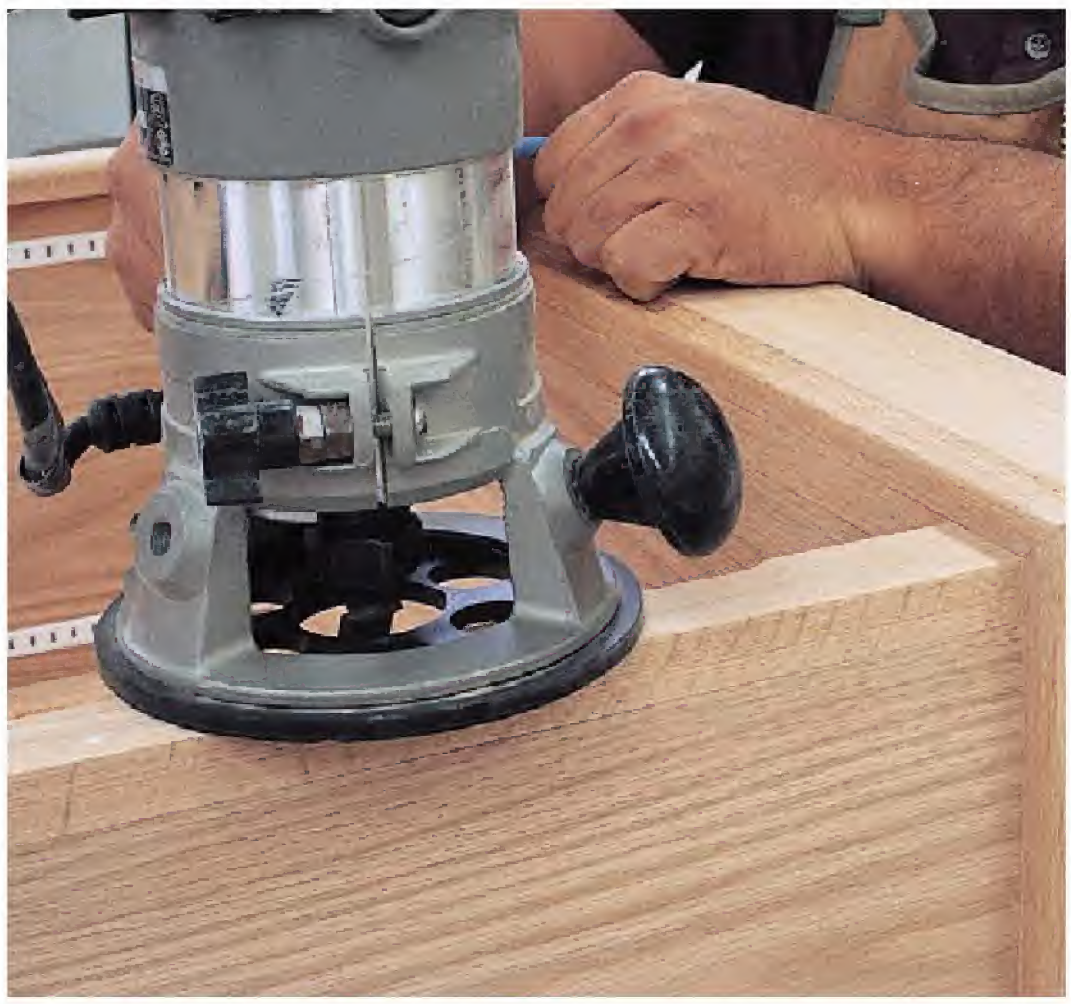
You can add a little interest and change the appearance of your bookcase by cutting flutes in the stile faces. A V-bit installed in a router can create an interesting pattern. The cut depth controls flute width.

5 Attach the stiles flush with the outside face of each side board. There are a number of methods you can use to attach the stiles. Glue and clamps, glue with biscuits, or simply glue and face nailing with finishing nails are all acceptable. I used the glue-and-face-nail method and filled the nail holes with colored wood filler to match my final finish. Install one stile at this time. Attach the other side after the upper rail is secured.

6 The upper rail is installed with biscuits into the side of each stile. Additionally, apply glue to the edge of the carcass top board and face nail the rail. After the rail is secured, install the remaining stile.

7 Attach the hardwood strip (F) to the front edge of the bottom shelf. This will extend the bottom shelf making it flush with the stile faces. Glue and nail the strip in place and don't be concerned about filling the nail head holes as they will be covered by the base trim.

8 The base trim measurements in the cutting list are taken at the longest point of the 45° angle cuts. The top edge of the trim is decorated with a cove bit in a router. Attach the baseboards with glue and 1¼" screws on the backside. These trim boards should be installed flush with the top surface of the bottom board.



9 Before installing the top trim, round over the inside edges of the two stiles and top rail with a ⅜" roundover bit. The router base plate will be stopped by the base trim and determines the point at which the roundover stops on each stile.

11 Before standing the bookcase upright, round over the outside edges of both stiles. Use a ⅜" roundover bit in a router. The upper and lower trim boards will stop the router travel and determine the cut length.

10 Cut the three pieces of top trim moulding at 45°. Use the dimensions in the cutting list as a guide — verify the measurements on your bookcase before cutting the trim to size. Use glue and nails to attach the moulding.

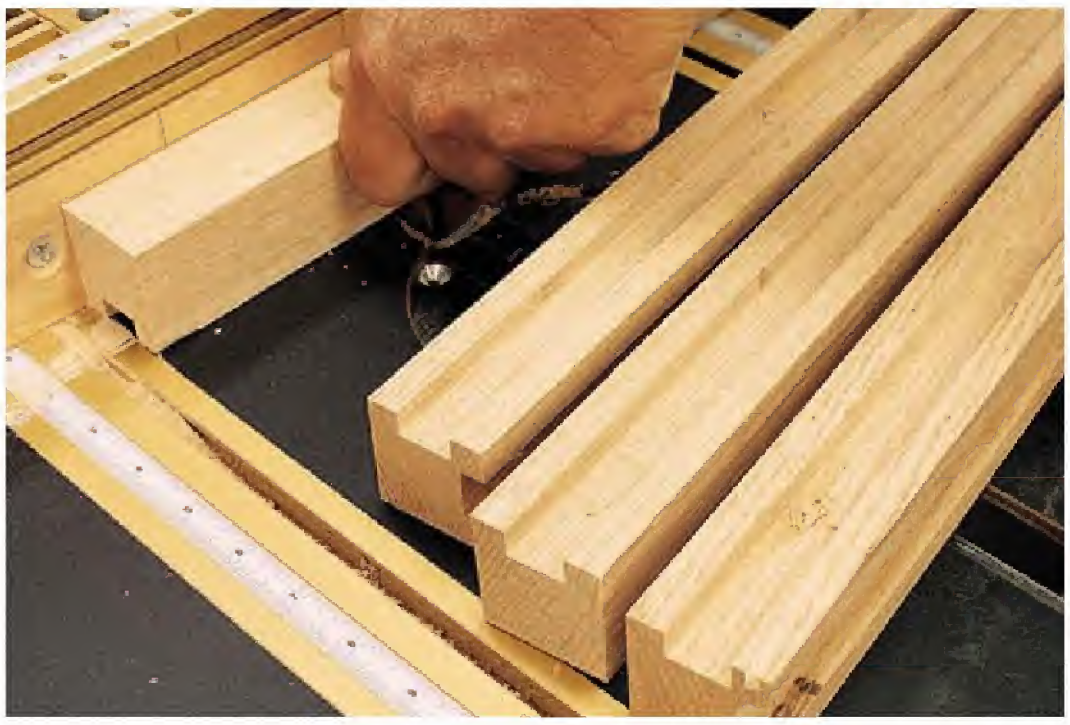
12 Cut the four shelf boards (K). The front trim pieces (L) for the shelves will make them appear thicker and add a great deal of strength to the boards. Use glue and nails or biscuits to attach the edges. Round over the top and bottom with a ⅜" roundover bit.

Credenza & Hutch

Here is a project that will go a long way toward meeting your home office cabinet requirements. This credenza and bookcase hutch project is an ideal place to store all your stationery and reference materials. Everything is stored in one place so it's a breeze to quickly get what you need. The door cabinets and drawer assembly can be modified to meet your specific needs. Or, leave that section out and the credenza can be used as a desk or worktable because it's 30" high.

I've used one of my favorite building materials — multi-core veneer-covered plywood. It's strong, stable, and can be glued, screwed or nailed. Threaded fasteners work great in this material as long as the proper pilot hole is drilled. Plate joinery, commonly called biscuit joints, is another option that I often use with great success when building furniture with this material.

The credenza top and cabinet legs are solid wood. I've opted for red oak, but any wood species that matches your décor is perfectly acceptable.



1 Prepare the four legs for the storage credenza by cutting them to size. The legs require a groove that's ¾"-wide × ⅜"-deep × 23"-long measured from the top of each leg. Two of the legs need a groove on one face. And the two back legs require two grooves on adjoining faces. Center the grooves on the leg faces. The simplest way to make the grooves is with a ¾"-wide router bit in a table-mounted router.

2 Replace the straight router bit with a ⅜" roundover bit and ease all the edges on each leg. Now is an ideal time to sand the legs.

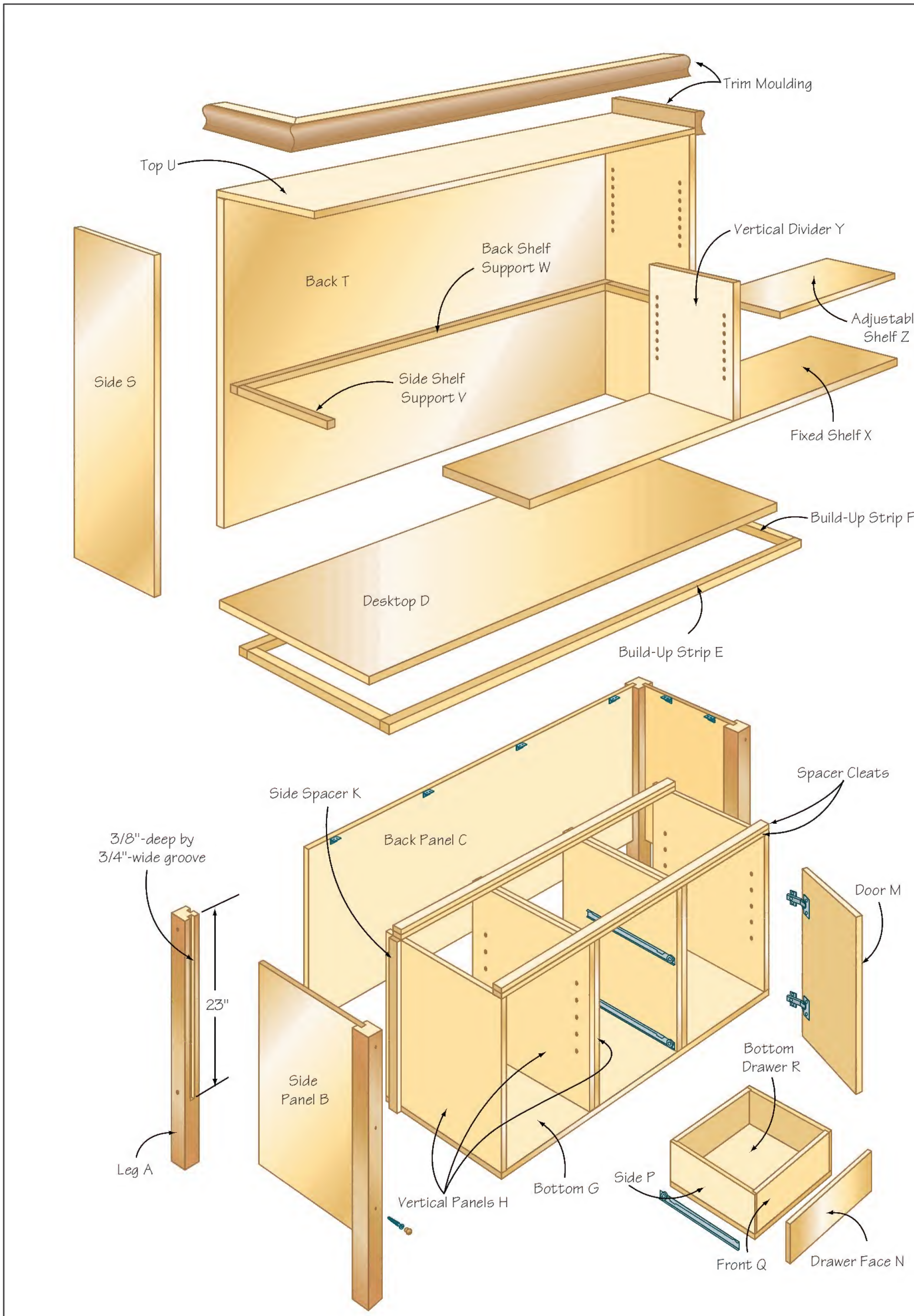
3 The straight router bit used in Step 1 will leave a rounded end on each groove. Use a sharp chisel to square the ends so the panels will fit correctly.

4 Cut the two side and back panels to size. The panel ends fit in the grooves of the legs with the double-grooved legs at the back. Put glue in the joint and drive 2" wood screws through the legs and into the panel ends. Two screws per panel end will secure the joint. Drill a pilot hole for the screws and a counterbored ⅜" hole for the screw head. Fill the holes with wood plugs and sand smooth.

5 **ABOVE LEFT** Attach seven right-angle brackets to the top edge of the panels. Two per side and three on the back panel will be used to secure the credenza top.

6 **ABOVE RIGHT** The finished size for the solid wood top will be 21½"-deep × 60½"-wide. Glue up enough ¾"-thick boards to form a top that's about 1" greater in size (biscuit joints are an ideal way to do this). A jointer will dress the edges perfectly, or you can get acceptable glue edges by cutting the boards on a well-tuned table saw. If you don't have a jointer and your saw can't cut a fine edge, most lumberyards will dress the boards for a small fee.

7 **LEFT** Sand the top smooth and trim to the correct finished size. Attach the build-up strips and secure with glue and brad nails. This will make the top appear thicker and heavier.


Trim Moulding
Top U
Vertical Divider Y
Back Shelf Support W
Back T
Adjustable Shelf Z
Side Shelf Support V
Side S
Fixed Shelf X
Build-Up Strip F
Desktop D
Build-Up Strip E
Spacer Cleats
Side Spacer K
Back Panel C
3/8"-deep by 3/4"-wide groove
Door M
23"
Side Panel B
Bottom Drawer R
Leg A
Vertical Panels H
Bottom G
Side P
Front Q
Drawer Face N

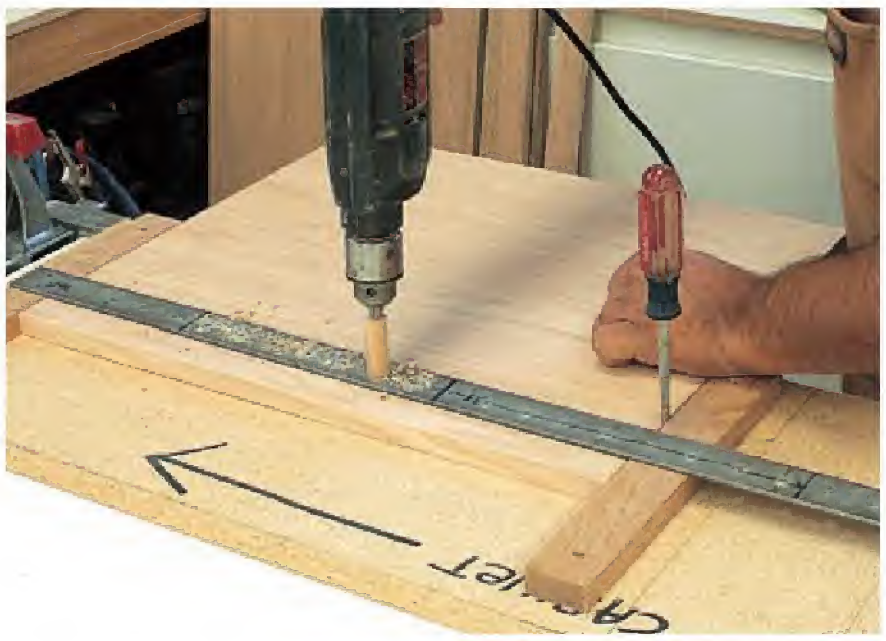
CUTTING LIST FOR FOR CREDENZA & HUTCH
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	4	legs	hardwood	1 5/8	(41)	1 5/8	(41)	29 1/4	(743)	
B	2	side panels	veneer ply	3/4	(19)	23	(584)	17	(432)	
C	1	back panel	veneer ply	3/4	(19)	23	(584)	56	(1422)	
D	1	desktop	hardwood	3/4	(19)	21 1/2	(546)	60 1/2	(1537)	make from glued-up boards
E	2	build-up strips	hardwood	3/4	(19)	3/4	(19)	60 1/2	(1537)	
F	2	build-up strips	hardwood	3/4	(19)	3/4	(19)	20	(508)	
G	1	bottom	veneer ply	3/4	(19)	18 1/4	(463)	55 1/4	(1403)	
H	6	vertical panels	veneer ply	3/4	(19)	18 1/4	(463)	20 3/4	(527)	
J	4	spacer cleats	veneer ply	3/4	(19)	1 1/2	(38)	55 1/4	(1403)	
K	2	side spacers	veneer ply	7/16	(19)	1 1/2	(38)	20 3/4	(527)	
L	2	shelves	veneer ply	3/4	(19)	15 7/8	(403)	18	(457)	
M	2	doors	veneer ply	3/4	(19)	17	(432)	21 7/8	(555)	
N	2	drawer faces	veneer ply	3/4	(19)	10 7/8	(276)	19 3/4	(502)	
P	4	drawer sides	birch ply	1/2	(19)	8 7/8	(225)	18	(457)	
Q	4	drawer f/b	birch ply	1/2	(19)	8 7/8	(225)	17 1/4	(438)	
R	2	drawer bottoms	birch ply	1/2	(19)	17 3/4	(451)	18	(457)	
HUTCH										
S	2	sides	veneer ply	3/4	(19)	11 1/4	(285)	47 3/4	(1213)	
T	1	back	veneer ply	3/4	(19)	47 3/4	(1213)	60	(1524)	
U	1	top	veneer ply	3/4	(19)	12	(305)	60	(1524)	
V	2	side supports	hardwood	3/4	(19)	1 1/2	(38)	11	(279)	
W	1	back supports	veneer ply	3/4	(19)	1 1/2	(38)	58 1/2	(1486)	
X	1	fixed shelf	veneer ply	3/4	(19)	11 1/4	(285)	58 1/2	(1486)	
Y	1	vertical divider	veneer ply	3/4	(19)	11 1/4	(285)	27 1/4	(692)	
Z	2	adj. shelf	veneer ply	3/4	(19)	11 1/4	(285)	28 13/16	(732)	

8 Use a small circular object to draw an arc at each corner of the top. Remove the wood outside the arc with a belt sander to round each corner. Next, install a 3/8" roundover bit in your router and dress the bottom and top edges.

9 Attach the top to the credenza base with 5/8"-long screws through the right-angle brackets. Verify that the top overhangs all leg faces by 1" before installing the screws. Do not use glue so the top can expand and contract during humidity level changes.

10 Cut all the panels for the drawer/door compartment. Apply iron-on wood veneer edge tape to the front long edge of the bottom board, the long edge of one spacer cleat, and the long front edge of each vertical panel.



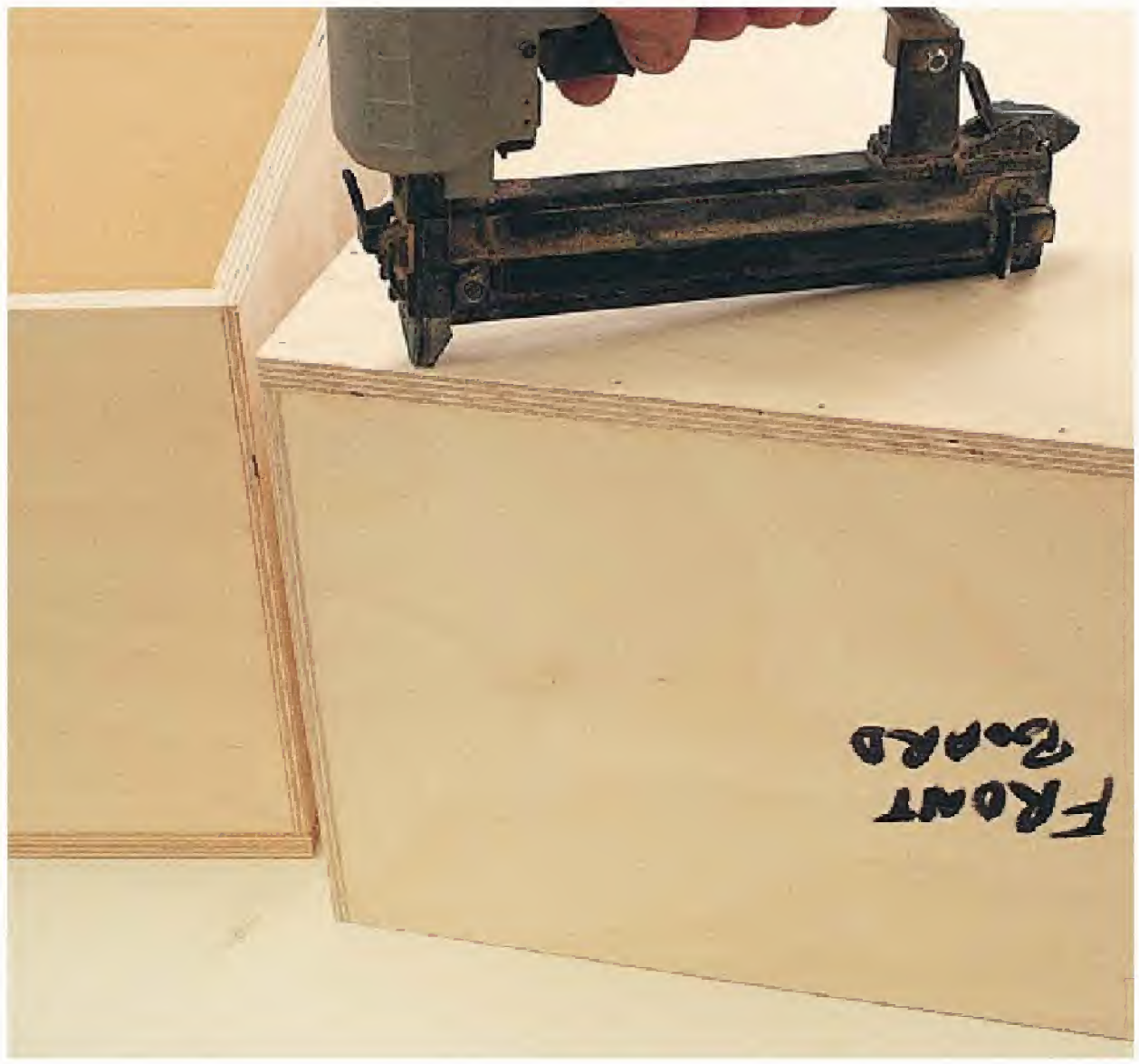
11 Drill holes in four of the vertical panels for the adjustable shelf pins you plan to use. You can make a simple shelf pin hole jig with flat iron and a couple of pieces of scrap lumber. Drill holes in the iron, spacing them about 1½" apart. Attach the iron to two wood cleats and use a dowel rod mounted on the drill bit to limit the hole depth.

12 Assemble the credenza with glue and 2" screws according to the illustration. The drawers will be in the center so the four panels with the shelf pin holes will be located facing each other on the two outside compartments. The cleat with the veneered edge is the lower front spacer cleat. Attach the front cleats flush with the front edge of the vertical panels. The rear cleats are spaced 1" in from the ends of all the panels to clear the countertop clips. Verify that the vertical panels are aligned and oriented correctly. The panels must be parallel to each other so the drawer hardware will operate properly.

13 Glue and nail the 7/16" spacer cleats on the rear outside faces of each end panel, 1" in from the back edge.

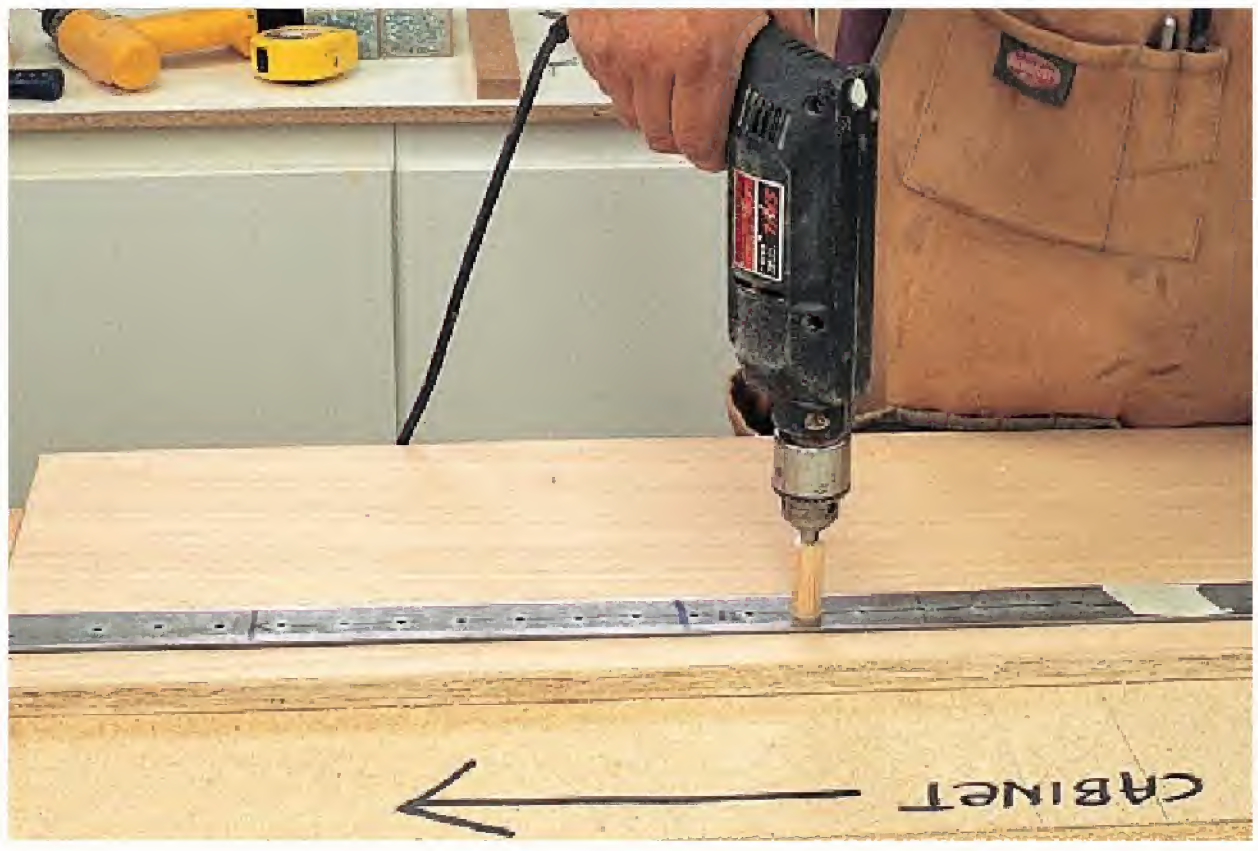
14 Lay the credenza on its back and install the compartment. Use 2" screws through the front panels into the front legs. Use 1½" screws through the rear end of each outside panel, through the side spacers, and into the inside face of each end panel. Drive an additional four 2" screws through the outside face of the rear credenza panel into the back edge of the bottom compartment board. Cut and apply edge tape to one front edge of both adjustable shelf boards.

15 The finished size for each door is 17"-wide × 21⅞"-high. You'll need two ¾"-thick wood veneer plywood panels 16"-wide × 20⅞"-high and about 15' of ½"-high × ¾"-thick solid wood to edge the panels. Build the two doors following the same procedures as detailed in chapter six. Round over the front face edges with a ⅜" router bit, drill the hinge holes and install the doors following the steps in chapter five.



16 Cut all the drawer parts to size. Remember to rabbet the back and front ends of each side ¼" deep × ½" wide. I've used ½"-thick Baltic birch plywood as I feel it's one of the best choices for office furniture drawer boxes. Follow the assembly procedures starting on page 142. The finished size of each drawer is 9⅜"-high × 18¾"-wide × 18"-deep. Install the bottom-mounted drawer glide and test fit both boxes. The first box is mounted ⅛" above the bottom board, and there should be a 1" space between the bottom and top box.

17 Two drawer faces, ¾"-thick × 10⅞"-high × 19¾"-wide, are required. They are built to match the door style with a blank ¾" veneer panel that's 9⅞" high × 18¾" wide. The panel is edged with ½"-high × ¾"-thick solid wood. Secure the drawer faces to the drawer boxes using four 1"-long screws from inside the drawer. The height of both drawer faces, plus a ⅛" space between them, should equal the door height.



18 The two side and vertical panels for the bookcase hutch require adjustable shelf pin holes. Begin drilling the holes starting 3" from the top edge of each board to a measurement 24" below the top edges. Space the holes 1¼" apart. The side panels each have two rows of holes on the inside face while the vertical divider (Y) requires holes on both faces. Drill the holes all the way through the divider panel. Apply wood edge veneer tape to one long edge on each board.

19 **LEFT** Prepare the backboard by applying wood veneer tape to two short edges. These edges will be visible on each side of the hutch. Attach the side boards to the backboard with glue and 2"-long screws. The outside faces of the side boards should be flush with the ends of the backboard and the shelf pin holes oriented properly.

20 **BELOW** Install the top board on the top edges of the side and back boards using glue and 2" screws. The edges of this panel do not require wood veneer tape, as they will be hidden with trim moulding. It isn't necessary to hide the screw heads, as the top will be on the credenza and over 6' in height.

21 The lower fixed shelf supports are made with 1×2 solid wood. They are cut at 45° to meet in the back corners. Before cutting the miters, round over the bottom edge as well as the front ends on the side supports. Use glue and 1¼" screws to secure the supports. The screws on the outside face of each side panel should be installed in counterbored holes that can be filled with wood plugs. The supports are secured 28" below the underside of the top board.

22 Dress one long front edge of the bottom fixed shelf with wood edge tape. Put the shelf on the supports; secure with glue and brad nails.

24 Install trim moulding around the top board. Cut the two adjustable shelves, tape the front edges, and install them on shelf pins.

23 Apply wood edge tape to the front of the vertical divider and secure it in place. Use glue and 2" screws through the top and bottom boards. The holes on the underside of the bottom board should be counterbored and filled with plugs.

Notes

The hutch can be secured to the credenza with screws through the underside of the top. One screw at each end, driven into the bottom of the side boards, will hold the hutch securely.

This project was finished with three coats of semi-gloss polyurethane. I used extra-fine steel wool to apply a low-luster paste wax to the finished piece for smoothness and extra protection.

Both credenza and hutch can be modified to suit your requirements. If you require a file drawer in the credenza, adjust the compartment dimensions accordingly.

building islands & peninsulas

While many of the techniques shown in this section for building islands and penninsulas highlight kitchen uses, many basements, and family room are now using these special cabinets to leave an open room feel, but still divide the area into separate functional spaces.

Peninsula With Seating

Seating at an island or peninsula that has an overhang usually means using stools or high bar-style chairs. Seat height is determined using the rule of 12s, which is a relationship of countertop to chair height. The standard 30"-high desk needs an 18"-high chair. An overhanging countertop that is 36" high requires a stool with a seat height of 24". Simply stated, the seat height should be 12" lower than the work-surface height for maximum comfort.

Peninsula Without Seating

Standard cabinet depth and width can be modified to build islands and peninsulas. Islands without seating can be standard- or increased-depth base cabinets. However, always calculate the total depth adding the doors, overhangs and finish trim on the rear of the cabinets. The ends of the island are finished because they are exposed, so remember to account for the extra width when determining countertop measurements.

Traffic patterns and safety are a concern when designing islands and peninsulas. Kitchen islands may be freestanding units or placed against a wall, more properly called a peninsula, and often define traffic patterns in the room. For this reason, countertop edges should be designed and constructed to minimize accidents, particularly with small children. Order your island countertops with radius edges or build a custom countertop with mitered corners. Always account for the loss in length because of these eased or radius ends when calculating your requirements.

I normally don't use adjustable legs for island or peninsula cabinet bases, because the cabinets must be anchored to the floor. Construct a base platform using ¾" plywood or construction-grade 1½"-thick lumber that's 4¼" high. Face the platform with 4¼"-high hardwood that matches the door and face-frame wood as the finished kick plate. The base frame, with finished face, should be 3" to 3½" in from all cabinet edges that are open.

Locate the platform on the floor and level if necessary. Use brackets to secure it to the floor. Anchor the cabinets through the bottom board to the platform using screws. The exposed heads of the screws can be covered with caps.

Islands must be finished on all four sides and peninsulas require finished surfaces on three sides. The doors and face frame are on one side, and the exposed melamine PB carcass is usually covered with ¼"-thick veneer plywood.

The perimeter of these covered sides can be trimmed with doorstop moulding with a right-angle trim piece on the corners. It's necessary to widen the stiles by ¼", making the overhang on the carcass sides larger to accommodate the thickness of plywood and perimeter trim.

Island and peninsula backs can be finished with ¼" veneer plywood and a flat trim around the perimeter of the cabinet. You can choose from dozens of trim options and styles to make these large surfaces interesting.

Changing the depth of base cabinets for an island work center is not a difficult process. The only carcass components that are altered are the depths of the sides and bottom board. All other dimensions remain constant in the standard cabinet.

The same holds true for increased-depth cabinets. These minor changes to meet custom requirements show the flexibility of this building system. You should be able to make changes to any of the standard cabinet dimensions to meet all of your needs.

Kitchen islands, whether fixed, peninsula or movable, give you an opportunity to design some unique and useful features in a kitchen. They can increase the counter space in a small kitchen and add a bit of flair to a large area. Often, I use the island and peninsula concept as area dividers to help define the kitchen space while maintaining the open feeling that most people desire in today's kitchens.

White melamine PB covered with ¼" veneer plywood isn't the only sheet material combination that can be used to build islands and peninsulas. Cabinets can be constructed using ⅝"- or ¾"-thick veneer-covered plywoods or particleboards. Both faces are covered with veneer that matches the cabinet doors and face frames, so all that's required is a little trim around the perimeter.

Mobile Islands

Kitchen islands that can be moved, sometimes called portable work centers, are another option that increases the functionality of a kitchen. Additional workspace is often required to meet meal preparation demands.

Any base cabinet can be adapted for use as a mobile island with a few modifications. For instance, if you want a movable island, construct a standard base unit without the legs. To strengthen the bottom board, attach pieces of ¾" wood, about 4" square, on all four corners of the cabinet. Make certain the wood fully covers the bottom edge of the cabinet side, so the wheel will properly support it. The overhang of the face frame will hide the front edges of the wood supports. The sides and back can have ¼" plywood veneer installed.

Attach four wheel assemblies to the bottom of the cabinet. Build the cabinet with 1¼"-wide stiles on the face frame, in place of the standard 1"-wide stiles, so you can install veneer plywood and doorstop moulding as the finish trim. The back of the cabinet can be finished in the same manner. Buy or build a countertop that overhangs the cabinet on all edges. Angle brackets will secure the countertop to the cabinet. You can also install a solid-surface countertop or even a granite slab, which will give you a beautiful and unique island.

The interior of the island cabinet can be designed in many ways. A standard drawer-over-door base will give you a useful place to put cutting utensils and other equipment. A full-door standard cabinet can be fitted with multiple adjustable shelves for storage. Vertical fixed shelving is another option if the island will be used to store cutting boards and large trays.

building frameless cabinetry

The European frameless cabinet is modular and commonly ranges in widths from 10" to 36". The frameless system offers flexibility with quality, and can be built with any ⅝"- or ¾"-thick sheet material; we are not restricted to white cabinets.

The Europeans perfected the box, or unitized, construction methods to a point where the frameless cabinet, often called the Euro-style kitchen, has become a popular option in North America. European design features such as the hidden hinge, bottom-mount drawer glides and adjustable cabinet legs are now an important part of the North American cabinetmaking industry.

The frameless cabinet parts can be cut, drilled, edge banded, finished and all hardware installed before the box is assembled. If necessary, the cabinet boxes can be shipped unassembled to the work site, then assembled and installed on site. This type of construction is very easy and fast with top-of-the-line results.

The kitchen cabinet building system described in this chapter is based on that box-style construction. The techniques apply to cabinet carcasses and drawer assemblies. Think of the construction system in its basic form and don't get confused with thinking in terms of the finished product. If you break the system down to the box concept — four sides and a bottom — you'll quickly understand and appreciate the simplicity of the construction methods.

Joinery

Butt joinery using particleboard screws is commonly used to build frameless cabinets.

The joints are almost all butt joints, secured with 2" screws designed specifically for particleboard material. The strength of the butt joint is due in large part to the holding ability of these screws. They are installed in a predrilled pilot hole and, because of their design, thread the hole, providing an extremely strong joint. When a panel is exposed, such as an end-of-run cabinet, biscuit joinery and glue is a preferred method because it's completely hidden.

Edge Banding

Frameless cabinets do not have a face frame, so the edges are covered with tape. Many edge tape materials are available that will match any sheet material you wish to use. Melamine and veneer tapes, with heat-sensitive glue, are a common item in most woodworking stores.

Edge tapes are applied with an iron or, if you plan on doing a lot of frameless cabinet work, a hot-air edge-banding station. The tape is applied to all visible edges on frameless cabinets.

Materials

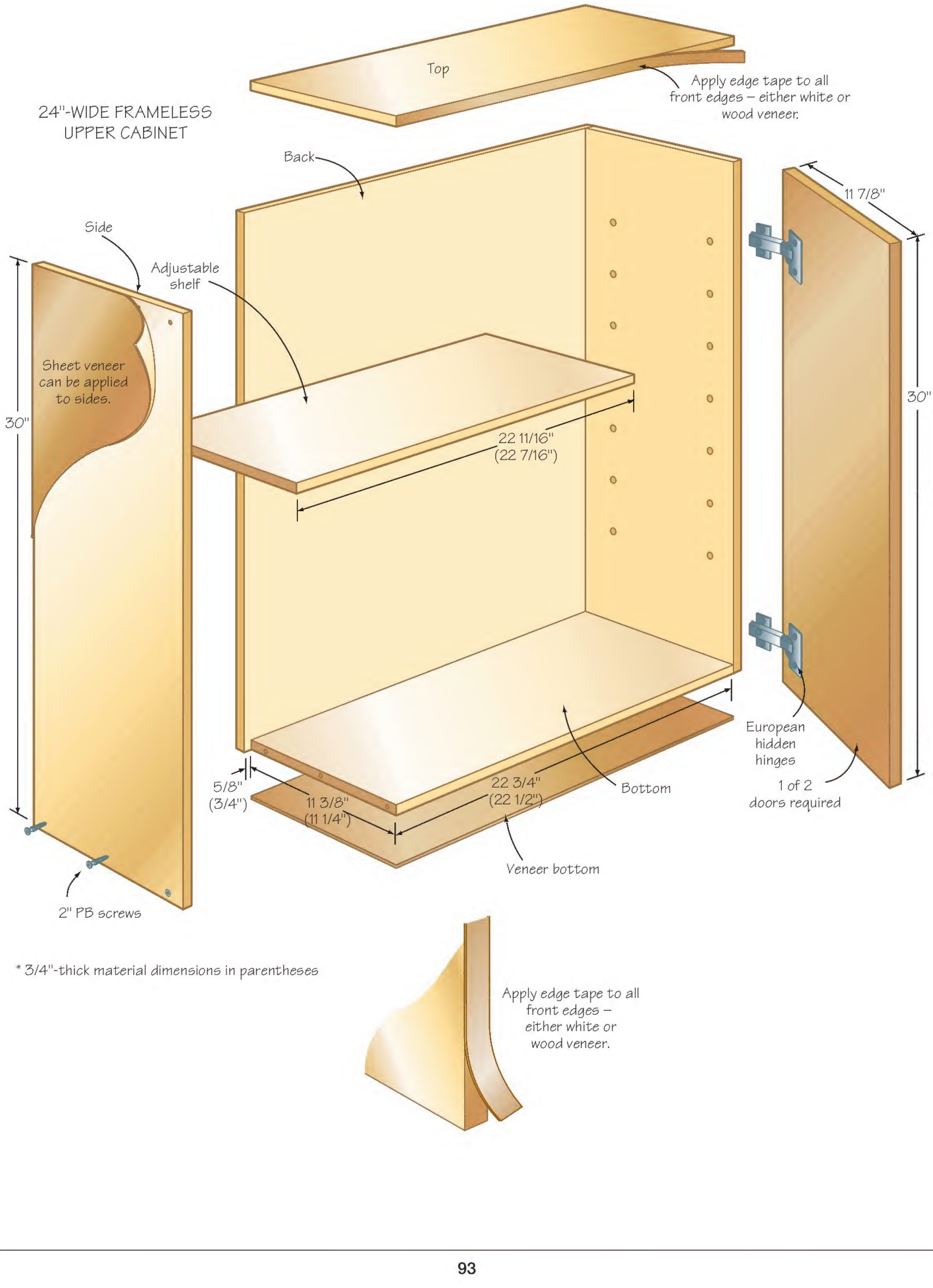
You have many sheet material options for building frameless cabinets. You can use particleboard, plywood or medium-density fiberboards. Particleboards are coated with paper and epoxy resin to create melamine particleboards in dozens of colors and textures. Wood-veneers are put on particleboard, plywood and medium density fiberboard. Many have an edge tape to match the surface material.

I suggest you use ⅝"- or ¾"-thick melamine particleboard material as your standard for carcass construction. As discussed, it's strong and able to accommodate the loading capacity that kitchen cabinets are often required to handle. A full ⅝"- or ¾"-thick back should also be standard. It provides many advantages, including the elimination of cabinet mounting strips that are normally seen on the inside top and bottom of cabinets. You'll end up with a stronger cabinet that stays square, reducing the twisting and racking that sometimes occurs during installation.

A commercial sheet material may be available in your area, that has a wood veneer on one side and a melamine coating on the opposite face. It's a great product to use when building frameless cabinets because you get the tough melamine finish on the inside with a wood-veneer exterior. This sheet material is commonly used by frameless cabinetmakers, and you'll often see examples in your local home or kitchen cabinet store.

As discussed earlier, make certain all boards are cut square and properly dimensioned. The two most critical boards, in terms of dimension, are the top and bottom, as they determine the inside width of the cabinet.

24"-WIDE FRAMELESS UPPER CABINET



* 3/4"-thick material dimensions in parentheses

Building Wall-Hung Frameless Cabinets

1 Cut the ⅝"- or ¾"-thick carcass parts to size. Use a table saw to cut the sides, bottom and top, back and two shelf boards to the proper dimensions. A table saw with a melamine particleboard blade will cut all the pieces cleanly. Number the parts as detailed on your cutting list and illustrations.

2 Drill the holes in each side board for the adjustable shelves, if needed. Be sure to mark the top of each panel. I normally start and end my columns of holes about 4" from the top and bottom edges. The hole columns are placed 1" in from the back and front edges and are the diameter required for the shelf pins you plan to use.

Calculating Cabinet Size

I've created a cutting list for ⅝"- and ¾"-thick sheet material, for many of the common frameless cabinet widths. However, you can calculate any width; you are not restricted to standard-size cabinets.

For example, a plan calls for an upper cabinet that's 27½" wide x 30" high x 12" deep with two shelves and two doors. That's all the information needed to create a cutting list. In this example I'll use ¾"-thick melamine particleboard to build the cabinet.

Cabinet width is always the front dimension. A 27½"-wide upper cabinet requires a bottom and top board that are 11¼" deep x 26" wide. The 11¼" depth plus the ¾"-thick back gives us a standard 12"-deep upper cabinet carcass. The 26"-wide top and bottom board, plus the thickness of two sides, equals our required cabinet width.

Side boards, or gables, are the same depth as the top and bottom boards at 11¼", and the full height of the finished cabinet at 30". The backboard equals the width and height of the finished cabinet, or 27½" (plus ⅛") wide x 30" high. Notice, as we did with the face-frame style of cabinets, the backboard is cut ⅛" wider to allow for any material thickness variances. The back can be trimmed to size just before it's installed. The adjustable shelves are the same depth as the top and bottom boards, and are normally 1/16" shorter in width to permit easy movement in the cabinet.

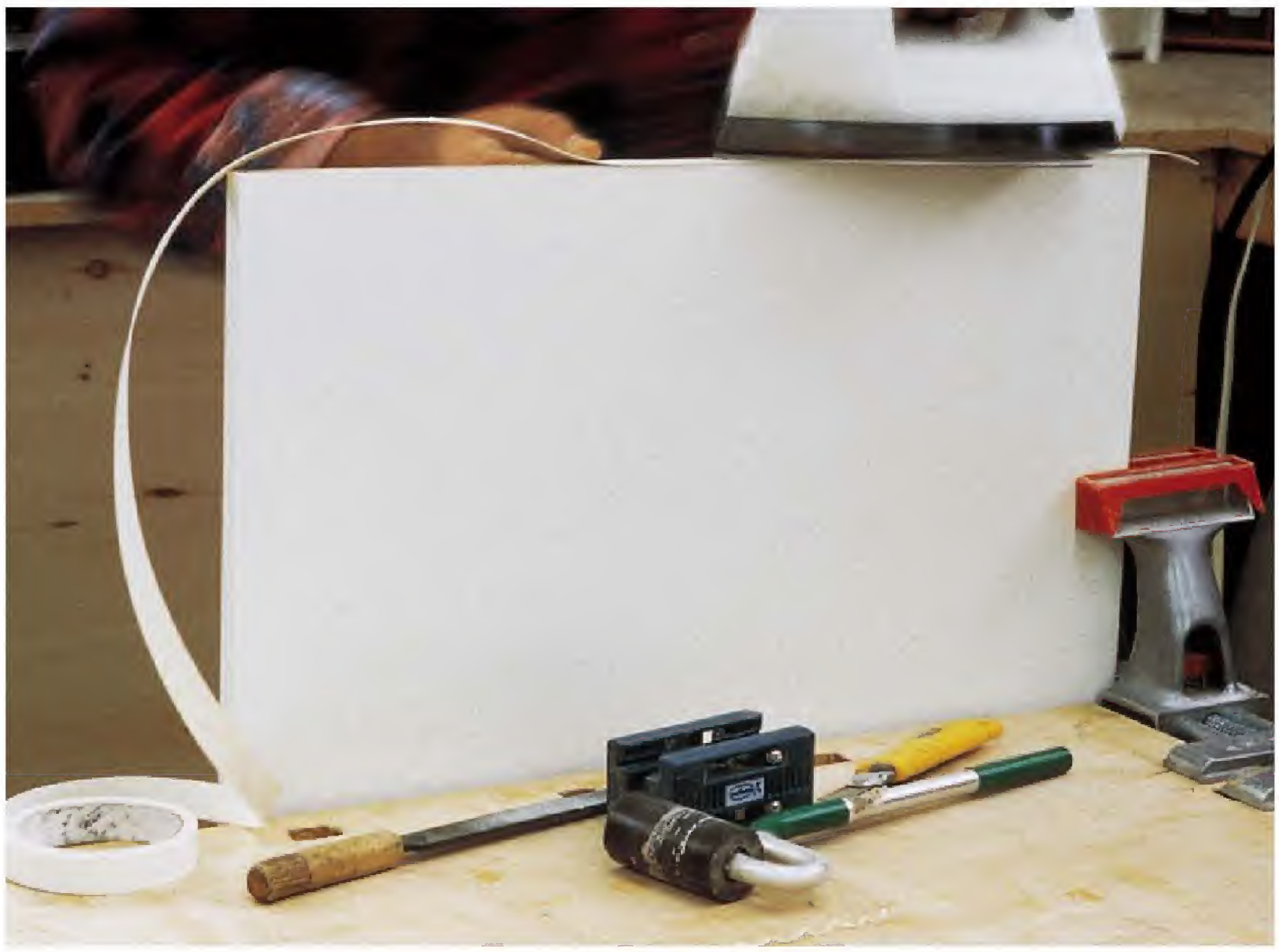
Door width is found using the same 1"-plus formula as previously detailed. The inside cabinet dimension of 26" plus 1" equals one door width. We need two doors, so dividing 27" x 2 means each door must be 13½" wide. Door height on frameless upper cabinets usually equals cabinet height, or 30".

CUTTING LIST FOR UPPER CABINETS USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX				
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	TOP & BOTTOM DEPTH × WIDTH	BACK WIDTH × HEIGHT	SHELF SIZE	DOOR WIDTH × 30" HIGH (762)
12 (305)	11 3/8 × 30 (289 × 762)	11 3/8 × 10 3/4 (289 × 273)	12 1/8 × 30 (308 × 762)	11 3/8 × 10 11/16 (289 × 272)	1 @ 11 3/4 (298)
15 (381)	11 3/8 × 30 (289 × 762)	11 3/8 × 13 3/4 (289 × 349)	15 1/8 × 30 (384 × 762)	11 3/8 × 13 11/16 (289 × 348)	1 @ 14 3/4 (375)
18 (457)	11 3/8 × 30 (289 × 762)	11 3/8 × 16 3/4 (289 × 425)	18 1/8 × 30 (460 × 762)	11 3/8 × 16 11/16 (289 × 424)	1 @ 17 3/4 (451)
21 (533)	11 3/8 × 30 (289 × 762)	11 3/8 × 19 3/4 (289 × 502)	21 1/8 × 30 (536 × 762)	11 3/8 × 19 11/16 (289 × 501)	2 @ 10 3/8 (264)
24 (610)	11 3/8 × 30 (289 × 762)	11 3/8 × 22 3/4 (289 × 578)	24 1/8 × 30 (613 × 762)	11 3/8 × 22 11/16 (289 × 577)	2 @ 11 7/8 (301)
27 (686)	11 3/8 × 30 (289 × 762)	11 3/8 × 25 3/4 (289 × 654)	27 1/8 × 30 (689 × 762)	11 3/8 × 25 11/16 (289 × 653)	2 @ 13 3/8 (340)
30 (762)	11 3/8 × 30 (289 × 762)	11 3/8 × 28 3/4 (289 × 730)	30 1/8 × 30 (765 × 762)	11 3/8 × 28 11/16 (289 × 729)	2 @ 14 7/8 (378)
33 (838)	11 3/8 × 30 (289 × 762)	11 3/8 × 31 3/4 (289 × 806)	33 1/8 × 30 (841 × 762)	11 3/8 × 31 11/16 (289 × 805)	2 @ 16 3/8 (416)
36 (914)	11 3/8 × 30 (289 × 762)	11 3/8 × 34 3/4 (289 × 883)	36 1/8 × 30 (917 × 762)	11 3/8 × 34 11/16 (289 × 882)	2 @ 17 7/8 (454)

CUTTING LIST FOR UPPER CABINETS USING 3/4" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

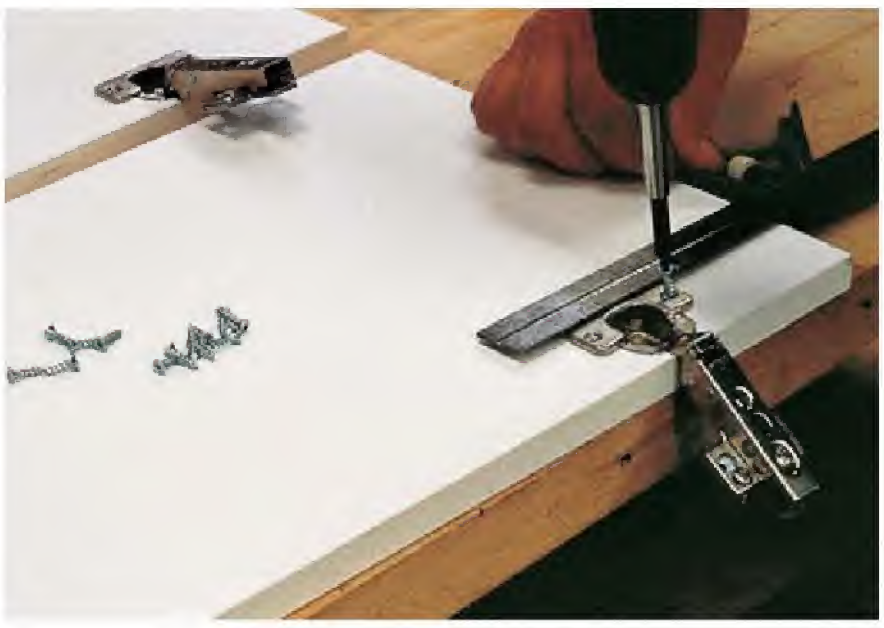
	CABINET BOX				
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	TOP & BOTTOM DEPTH × WIDTH	BACK WIDTH × HEIGHT	SHELF SIZE	DOOR WIDTH × 30" HIGH (762)
12 (305)	11 1/4 × 30 (285 × 762)	11 1/4 × 10 1/2 (285 × 267)	12 1/8 × 30 (308 × 762)	11 1/4 × 10 7/16 (285 × 265)	1 @ 11 1/2 (292)
15 (381)	11 1/4 × 30 (285 × 762)	11 1/4 × 13 1/2 (285 × 343)	15 1/8 × 30 (384 × 762)	11 1/4 × 13 7/16 (285 × 341)	1 @ 14 1/2 (369)
18 (457)	11 1/4 × 30 (285 × 762)	11 1/4 × 16 1/2 (285 × 419)	18 1/8 × 30 (460 × 762)	11 1/4 × 16 7/16 (285 × 417)	1 @ 17 1/2 (445)
21 (533)	11 1/4 × 30 (285 × 762)	11 1/4 × 19 1/2 (285 × 496)	21 1/8 × 30 (536 × 762)	11 1/4 × 19 7/16 (285 × 494)	2 @ 10 1/4 (260)
24 (610)	11 1/4 × 30 (285 × 762)	11 1/4 × 22 1/2 (285 × 572)	24 1/8 × 30 (613 × 762)	11 1/4 × 22 7/16 (285 × 570)	2 @ 11 3/4 (298)
27 (686)	11 1/4 × 30 (285 × 762)	11 1/4 × 25 1/2 (285 × 648)	27 1/8 × 30 (689 × 762)	11 1/4 × 25 7/16 (285 × 646)	2 @ 13 1/4 (336)
30 (762)	11 1/4 × 30 (285 × 762)	11 1/4 × 28 1/2 (285 × 724)	30 1/8 × 30 (765 × 762)	11 1/4 × 28 7/16 (285 × 722)	2 @ 14 3/4 (375)
33 (838)	11 1/4 × 30 (285 × 762)	11 1/4 × 31 1/2 (285 × 800)	33 1/8 × 30 (841 × 762)	11 1/4 × 31 7/16 (285 × 798)	2 @ 16 1/4 (412)
36 (914)	11 1/4 × 30 (285 × 762)	11 1/4 × 34 1/2 (285 × 877)	36 1/8 × 30 (917 × 762)	11 1/4 × 34 7/16 (285 × 875)	2 @ 17 3/4 (451)



3 Apply edge tape to all edges that will be visible once the cabinet is built. Normally the front and bottom edges of the side boards, the front edges of the top and bottom boards, the side and bottom edges of the backboard, and the front edges of the shelves are taped.

4 Fasten one side board to the edge of the bottom board, making sure the joint is square and flush. Drill a ⅛" countersunk pilot hole for each of the three 2" PB screws. Do not overtighten. Take care as well to drill the pilot hole so that it's in the center of the edge on the board you are fastening the side to; in this case, the bottom board of the carcass. Connect the remaining three corner butt joints in the same manner.

You can use biscuits, dowels or confirmat screws. With this frameless style of cabinetry, end gables that are exposed on any side will generally have a cover panel or, if left exposed, will be joined with biscuits.



6 Choose the style of door you would like to install. Door height for upper frameless cabinets with this building system is 30" high. The width of each door is dependent on the size of the carcass. Use the 1" rule as discussed in previous chapters. To review, the doors are 1" wider than the inside side-to-side distance. If you require two doors, simply divide the door width by two.

Drill a 35mm-diameter hole, 3" on center, from each end of the door, ⅛" away from the door's edge. Use a hinge-boring bit to drill the hole ½" deep, or as specified by the hinge supplier.

Attach a 100° to 120° standard-opening hinge with two ⅝" screws, using a square to make sure the hinge arm is at 90° to the door's edge. This is important because the hinge must be properly mounted to function correctly. Once the hinges are secure, attach the hinge plate to each hinge.

5 For purposes of verification at this point, referencing a 24"-wide upper cabinet as an example, you should have a four-sided box with inside dimensions of 22¾" (the width of the bottom and top carcass boards) by 28¾" high (the length of the side minus the thickness of the top and bottom carcass boards when using ⅝" sheet material).

Measure the actual width of the carcass. If the sheet material is slightly thicker than ⅝" or ¾", your carcass will be wider than planned. The backboard was cut slightly wider to accommodate that possibility. Trim the back to the correct size before attaching it to the carcass.

Secure the backboard to the carcass, flush with all edges of the box. This will force the cabinet corners into square. Install 2" PB screws at 6" centers around the perimeter of the back. Secure the first corner, aligning it square, then secure the remaining three corners while aligning the box. Finally, install screws between the corners. Always drill a pilot hole for the screws, as this will guarantee the best hold possible. Use a marking gauge to draw lines 5/16" (or ⅜" for ¾"-thick board) in from the edges as a guide for the pilot holes.

7 Hold the door in its normally open position, with the hinge and plate attached to the door, and place a ⅛"-thick spacer between the cabinet's front edge and the back edge of the door. Drive screws through the hinge plate and into the cabinet side to secure the doors.

8 To complete the standard upper cabinet, install shelf pins, test fit the shelves and attach handles or knobs of your choice. The shelf's front edge can be covered with iron-on melamine edge tape, a plastic cap moulding that's available at your local home store or wood edge trim to match the doors.

Building a 24" Frameless Upper Corner Cabinet

This special upper corner cabinet is not as straightforward as the standard upper cabinets, and does require a little extra attention during construction. The building style that's illustrated is one of the two or three construction methods that can be used. This is the construction style I use and, I believe, is one of the better methods of building an upper corner cabinet.

This cabinet is called a 24" upper corner because it covers 24" on each wall of a corner. The face is at a 45° angle to the cabinets on either side. Dead space, often found in corner wall cabinets, is minimized by the installation of a two-shelf lazy Susan assembly.

As illustrated in the tables, pay particular attention to the backboard cut sizes. One back is ⅝" or ¾" wider to allow for the required overlaps of the boards during assembly.

CUTTING LIST FOR A 24" (610MM) UPPER CORNER CABINET USING ⅝" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

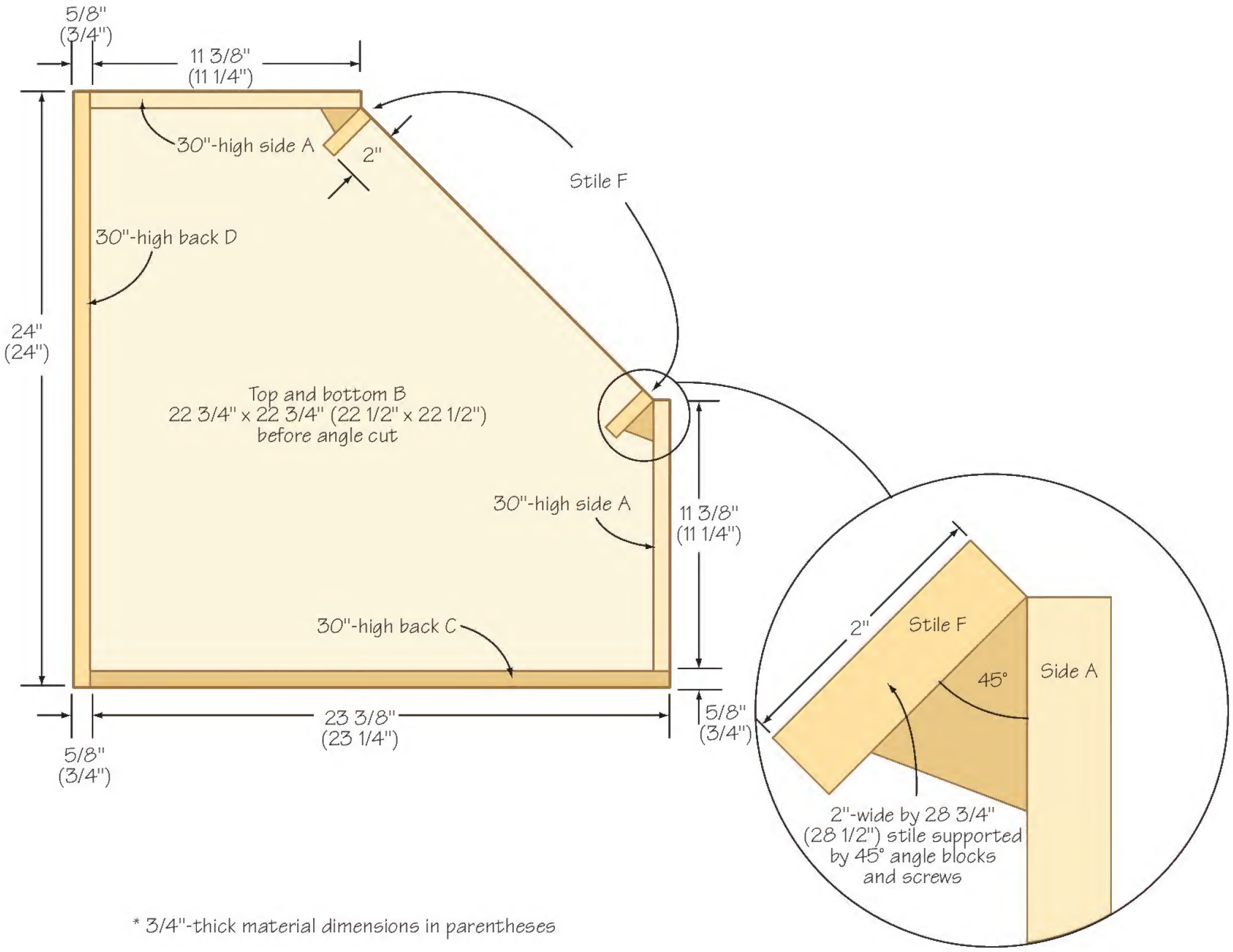
REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	⅝	(16)	11⅜	(289)	30	(762)	
B	2	top & bottom	melamine pb	⅝	(16)	22¾	(578)	22¾	(578)	cut as illustrated
C	1	back	melamine pb	⅝	(16)	23⅜	(594)	30	(762)	
D	1	back	melamine pb	⅝	(16)	24	(610)	30	(762)	
E	1	door	melamine pb	⅝	(16)	15¾	(400)	30-high	(762)	
F	2	stiles	melamine pb	⅝	(16)	2	(51)	28¾	(730)	install as detailed with 45° corner blocks

CUTTING LIST FOR A 24" (610MM) UPPER CORNER CABINET USING ¾" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

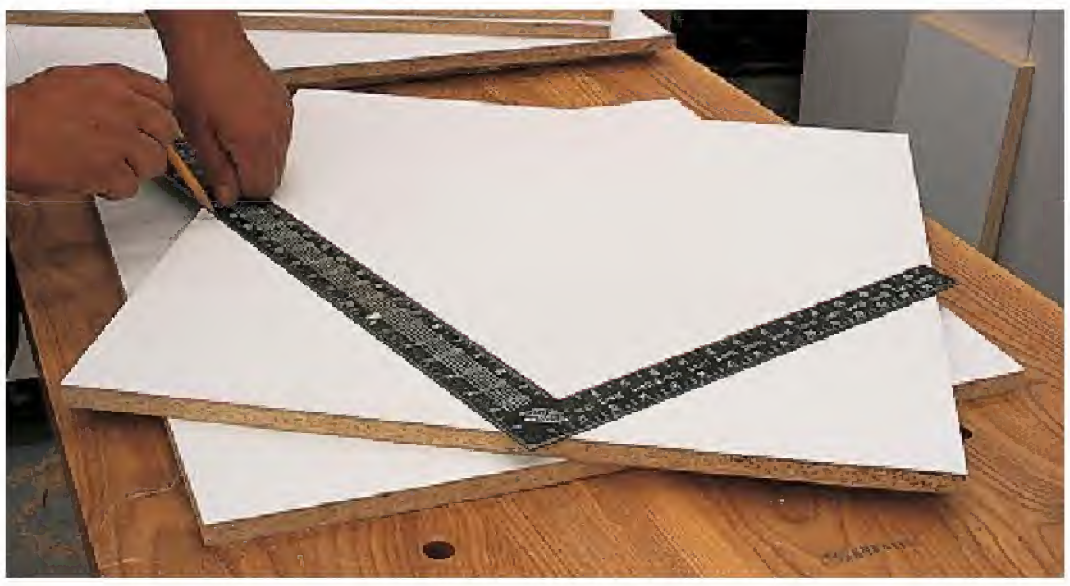
REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	¾	(19)	11¼	(285)	30	(762)	
B	2	top & bottom	melamine pb	¾	(19)	22½	(572)	22½	(572)	cut as illustrated
C	1	back	melamine pb	¾	(19)	23¼	(590)	30	(762)	
D	1	back	melamine pb	¾	(19)	24	(610)	30	(762)	
E	1	door	melamine pb	¾	(19)	15½	(394)	30-high	(762)	
F	2	stiles	melamine pb	¾	(19)	2	(51)	28½	(724)	install as detailed with 45° corner blocks

24" FRAMELESS UPPER CORNER CABINET

- An 18"-diameter lazy Susan is suggested.
- Door is 15 3/4" wide by 30" high with 5/8" material.
  Door is 15 1/2" wide by 30" high with 3/4" material.



* 3/4"-thick material dimensions in parentheses



1 Six boards are required for this cabinet; cut as indicated. This cabinet is almost always fitted with a two-shelf, 18"-diameter round lazy Susan assembly, and therefore holes for adjustable shelves are not required.

2 Mark the angle cuts on the top and bottom boards. If you have a sliding table on your saw, or an angle-cutting jig, prepare the boards as indicated in the drawing. You can cut the front angles with a circular saw or jigsaw, keeping ⅛" away from the line, then dress the boards to the line with a belt sander. Take your time and you'll get an accurate cut with minimum chipping of the melamine coating.

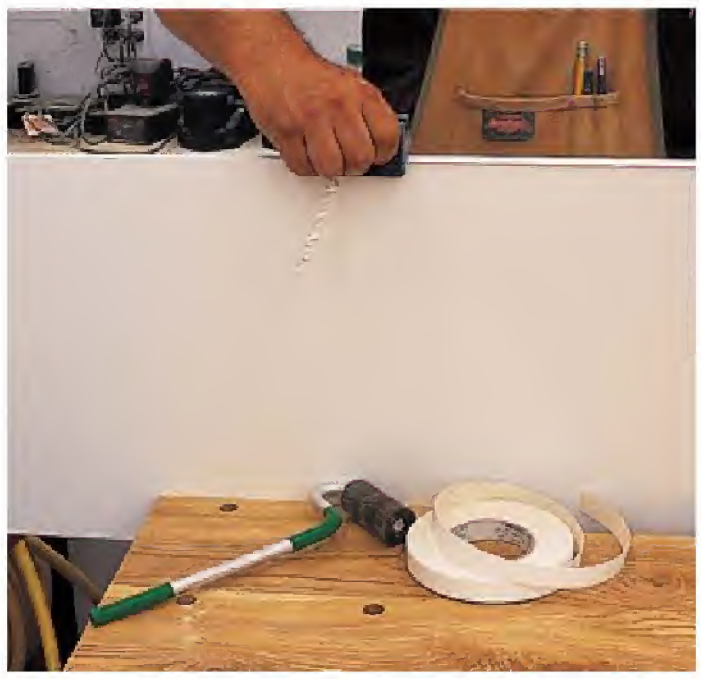
3 Apply edge tape to all the boards that will have their edges exposed after the cabinet has been installed. If cabinets will be on either side, the side edges of the backs do not have to be covered. Don't forget to edge-tape the bottom edges of all panels.

4 Assemble the carcass as detailed in the technical drawing, with the exception of the two stiles and corner blocks. Use 2"-long particleboard screws in pilot holes to secure all the cabinet parts.

5 **FAR LEFT** Cut two wood strips 1¾" wide across the angled face, and equal to the length of the stiles (detailed in the cutting lists) with a 45° ripped edge running the length of each strip. Fasten the strips to the cabinet sides, about 1/16" behind the front inside edge of each gable, using 1"-long screws through the outside face of each side panel.

6 **LEFT** The two stiles are made using the same material as the cabinet carcass. Apply edge tape to both front and back long edges. Place each stile in the cabinet with one edge at 90° to the top and bottom boards' front edge. The stile corner should be held tight to the gable corner edge on each side and rest against the wood strips.

Drive 1½"-long particleboard screws through the top and bottom boards into the ends of each stile. Install four additional screws on each side through the face of each stile into the wood strip. Both stiles should be securely held in place.



7 Cut the door to the size indicated based on the thickness of material you are using. Apply edge tape to all four edges of the door.

8 Drill hinge holes in the door and install standard hinges and plates as previously detailed. Hold the door in its normally open position with a 1/8"-thick spacer between the door and cabinet stile edge. Attach the hinges to one 2"-wide stile and test the door operation.

9 Leave the hinge plates in place on the stiles. Remove the standard-opening hinges and replace them with 170°-opening hinges. The wide-swing hinges are necessary on this angled corner cabinet for easy access to the interior. Install a two-shelf, 18"-diameter, full-round lazy Susan, following the manufacturer's instructions, to complete the cabinet.

Building Frameless Base Cabinets

The basic frameless base cabinet is a box with two sides, called gable ends, a bottom board and a backboard. There is normally a door or door-and-drawer combination with fixed or adjustable shelving inside the cabinet.

All cabinets are not the same width. We often need specific width cabinets to fill dedicated spaces. If the width required doesn't match the sizes in the chart, follow the procedures described in "Calculating Cabinet Size" on page 94.

Standard base cabinets are 36" high when complete. That height accounts for the cabinet base support and the countertop thickness. For these cabinets I will be using plastic adjustable legs, but you can construct a wood base just as easily.

As discussed earlier in this chapter, the backboard is cut ⅛" wider to allow for any material thickness variances. The back can be trimmed to size just before it's installed. The adjustable shelves are the same depth as the top and bottom boards, and normally 1/16" shorter in width to permit easy movement in the cabinet.

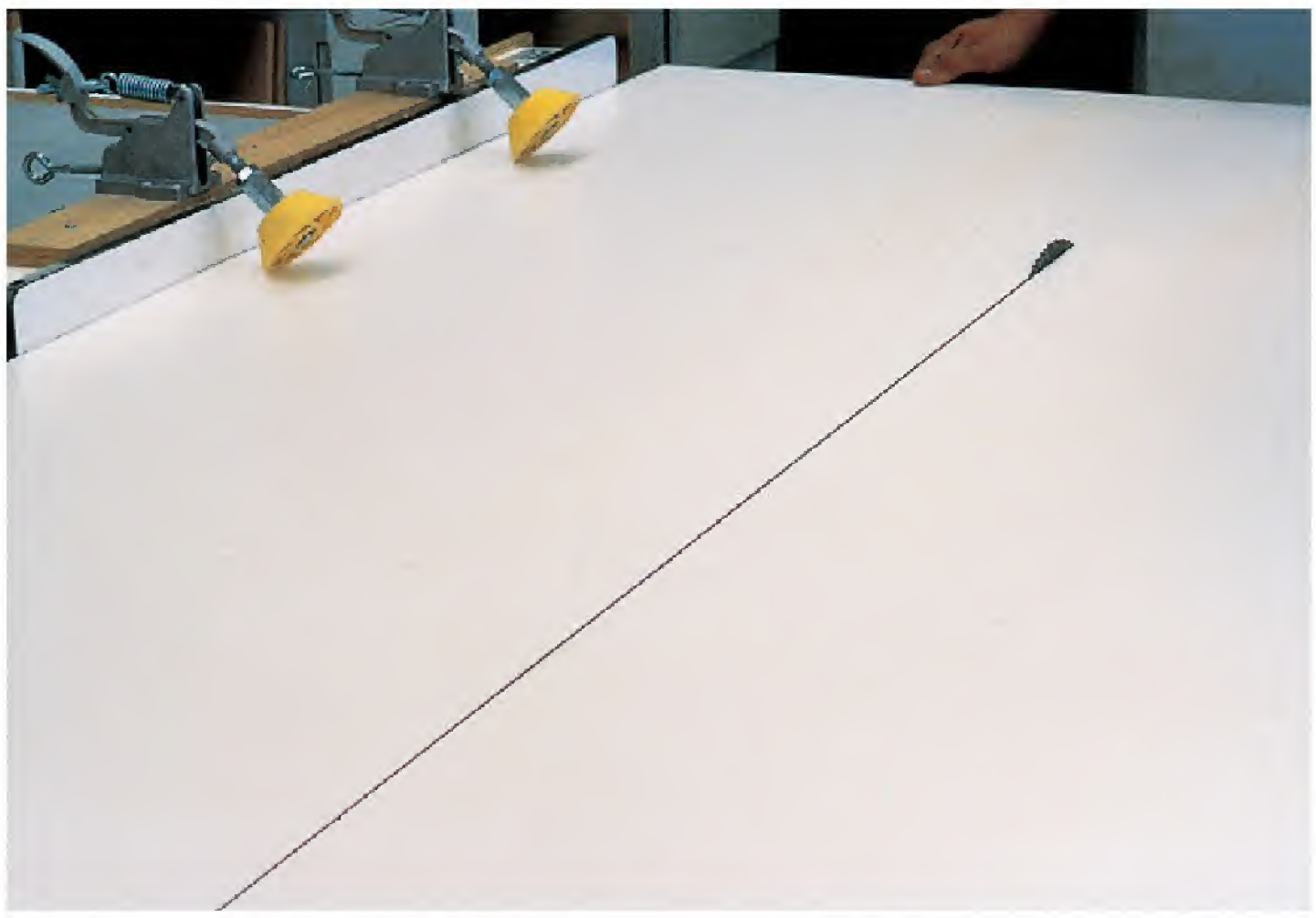
Frameless base cabinets do not need a top board, because the countertop covers the cabinet, but they do require an upper rail so the door clears the countertop. For my cabinets, I install a 2"-high rail as shown in this photograph. The height is constant regardless of the cabinet width, and the rail width is equal to the bottom board's width.

CUTTING LIST FOR BASE CABINETS USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

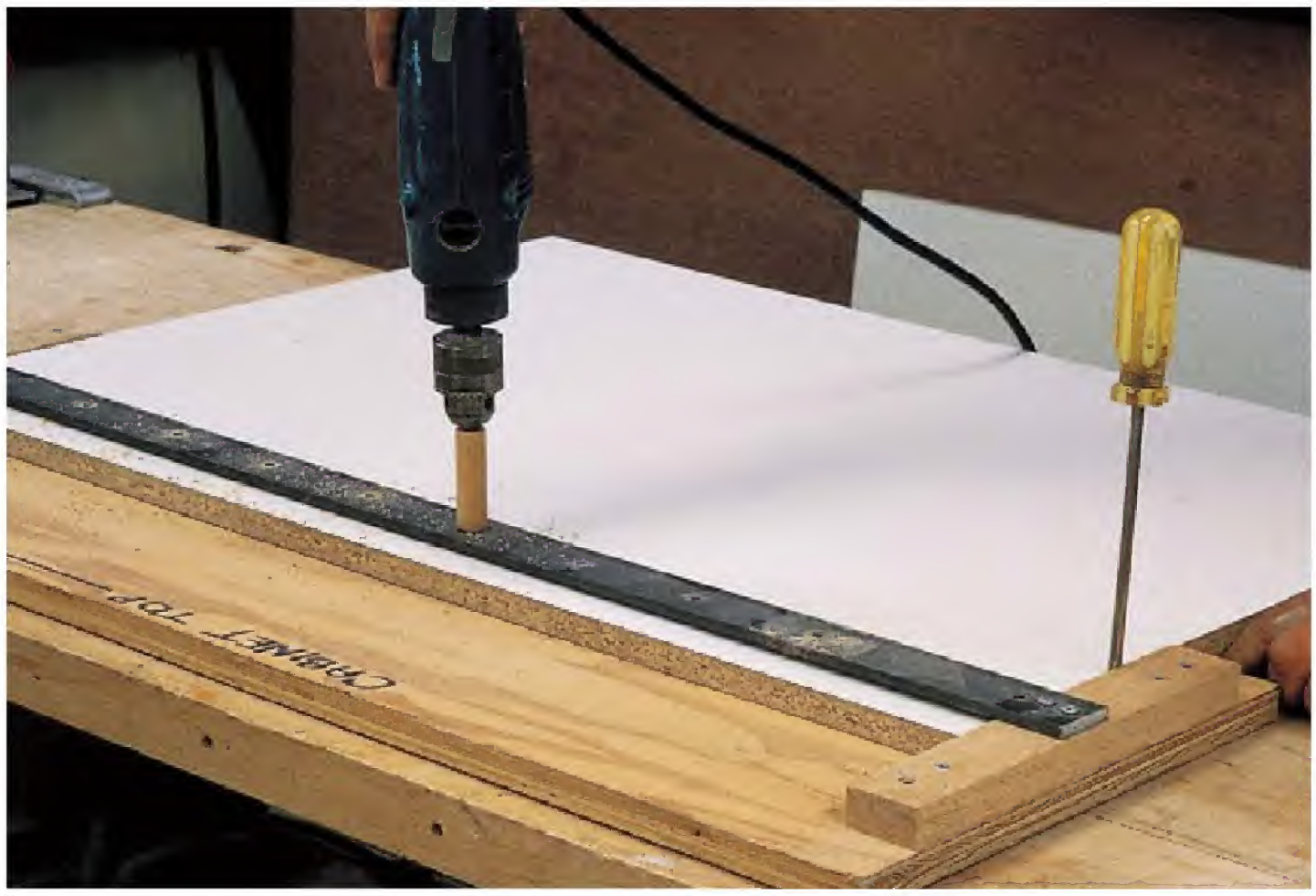
	CABINET BOX				
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	BOTTOM DEPTH × WIDTH	BACK WIDTH × HEIGHT	SHELF SIZE	DOOR WIDTH × 30" HIGH (762)
12 (305)	23 3/8 × 31 (594 × 787)	23 3/8 × 10 3/4 (594 × 273)	12 1/8 × 31 (308 × 787)	23 3/8 × 10 11/16 (594 × 272)	1 @ 11 3/4 (298)
15 (381)	23 3/8 × 31 (594 × 787)	23 3/8 × 13 3/4 (594 × 349)	15 1/8 × 31 (384 × 787)	23 3/8 × 13 11/16 (594 × 348)	1 @ 14 3/4 (375)
18 (457)	23 3/8 × 31 (594 × 787)	23 3/8 × 16 3/4 (594 × 425)	18 1/8 × 31 (460 × 787)	23 3/8 × 16 11/16 (594 × 424)	1 @ 17 3/4 (451)
21 (533)	23 3/8 × 31 (594 × 787)	23 3/8 × 19 3/4 (594 × 502)	21 1/8 × 31 (536 × 787)	23 3/8 × 19 11/16 (594 × 501)	2 @ 10 3/8 (264)
24 (610)	23 3/8 × 31 (594 × 787)	23 3/8 × 22 3/4 (594 × 578)	24 1/8 × 31 (613 × 787)	23 3/8 × 22 11/16 (594 × 577)	2 @ 11 7/8 (301)
27 (686)	23 3/8 × 31 (594 × 787)	23 3/8 × 25 3/4 (594 × 654)	27 1/8 × 31 (689 × 787)	23 3/8 × 25 11/16 (594 × 653)	2 @ 13 3/8 (340)
30 (762)	23 3/8 × 31 (594 × 787)	23 3/8 × 28 3/4 (594 × 730)	30 1/8 × 31 (765 × 787)	23 3/8 × 28 11/16 (594 × 729)	2 @ 14 7/8 (378)
33 (838)	23 3/8 × 31 (594 × 787)	23 3/8 × 31 3/4 (594 × 806)	33 1/8 × 31 (841 × 787)	23 3/8 × 31 11/16 (594 × 805)	2 @ 16 3/8 (416)
36 (914)	23 3/8 × 31 (594 × 787)	23 3/8 × 34 3/4 (594 × 883)	36 1/8 × 31 (917 × 787)	23 3/8 × 34 11/16 (594 × 882)	2 @ 17 7/8 (454)

CUTTING LIST FOR BASE CABINETS USING ¾" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

	CABINET BOX				
CABINET WIDTH	TWO SIDES DEPTH × HEIGHT	BOTTOM DEPTH × WIDTH	BACK WIDTH × HEIGHT	SHELF SIZE	DOOR WIDTH × 30" HIGH (762)
12 (305)	23¼ × 31 (590 × 787)	23¼ × 10½ (285 × 267)	12⅛ × 31 (308 × 787)	23¼ × 10 7/16 (590 × 265)	1 @ 11½ (292)
15 (381)	23¼ × 31 (590 × 787)	23¼ × 13½ (285 × 343)	15⅛ × 31 (384 × 787)	23¼ × 13 7/16 (590 × 341)	1 @ 14½ (369)
18 (457)	23¼ × 31 (590 × 787)	23¼ × 16½ (285 × 419)	18⅛ × 31 (460 × 787)	23¼ × 16 7/16 (590 × 417)	1 @ 17½ (445)
21 (533)	23¼ × 31 (590 × 787)	23¼ × 19½ (285 × 496)	21⅛ × 31 (536 × 787)	23¼ × 19 7/16 (590 × 494)	2 @ 10¼ (260)
24 (610)	23¼ × 31 (590 × 787)	23¼ × 22½ (285 × 572)	24⅛ × 31 (613 × 787)	23¼ × 22 7/16 (590 × 570)	2 @ 11¾ (298)
27 (686)	23¼ × 31 (590 × 787)	23¼ × 25½ (285 × 648)	27⅛ × 31 (689 × 787)	23¼ × 25 7/16 (590 × 646)	2 @ 13¼ (336)
30 (762)	23¼ × 31 (590 × 787)	23¼ × 28½ (285 × 724)	30⅛ × 31 (765 × 787)	23¼ × 28 7/16 (590 × 722)	2 @ 14¾ (375)
33 (838)	23¼ × 31 (590 × 787)	23¼ × 31½ (285 × 800)	33⅛ × 31 (841 × 787)	23¼ × 31 7/16 (590 × 798)	2 @ 16¼ (412)
36 (914)	23¼ × 31 (590 × 787)	23¼ × 34½ (285 × 877)	36⅛ × 31 (917 × 787)	23¼ × 34 7/16 (590 × 875)	2 @ 17¾ (451)



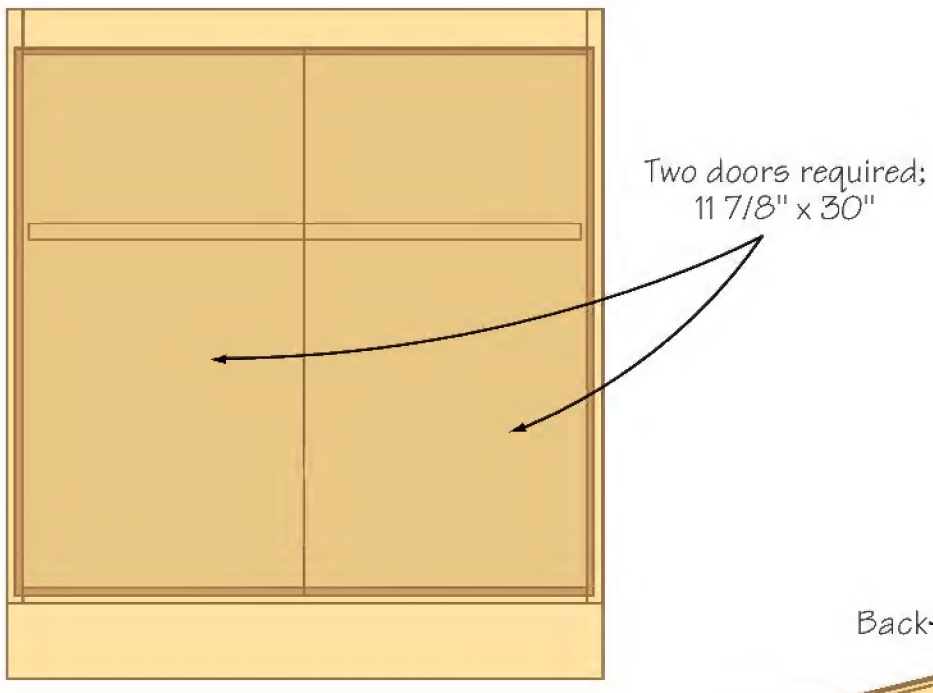
1 Cut all the parts as detailed in the cutting list charts, or based on your calculations for cabinet widths not detailed. Use a particleboard blade on your table saw and carefully cut the parts. The rails for each cabinet are the same width as the bottom board and 2" high. One rail is needed for each standard full-door base cabinet.

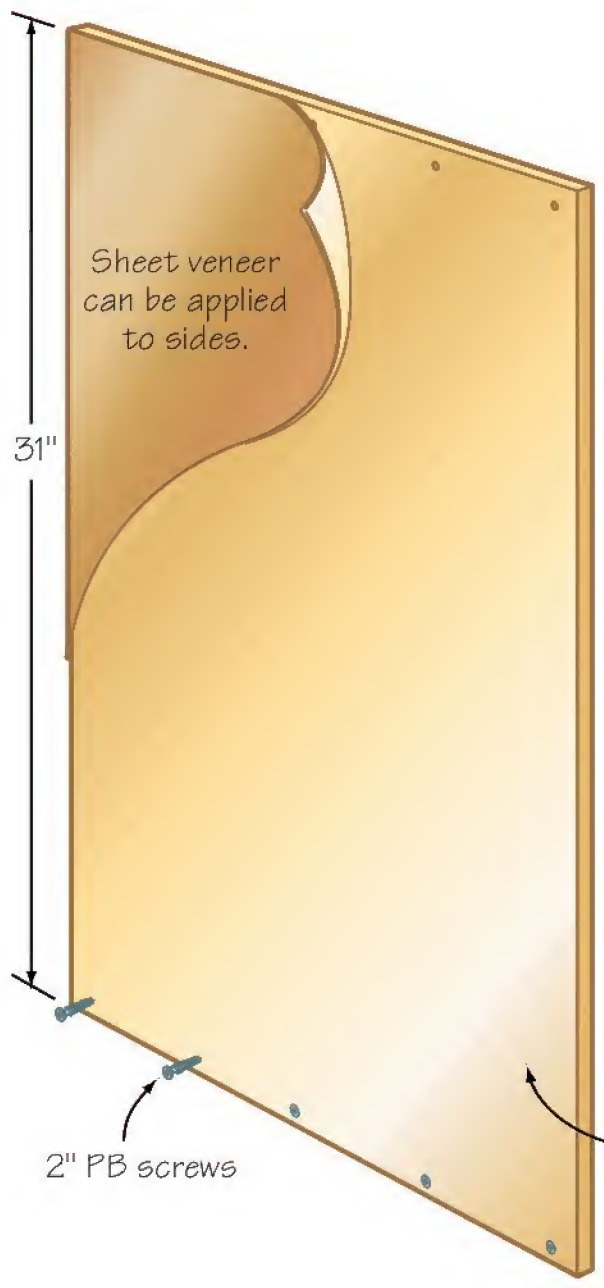


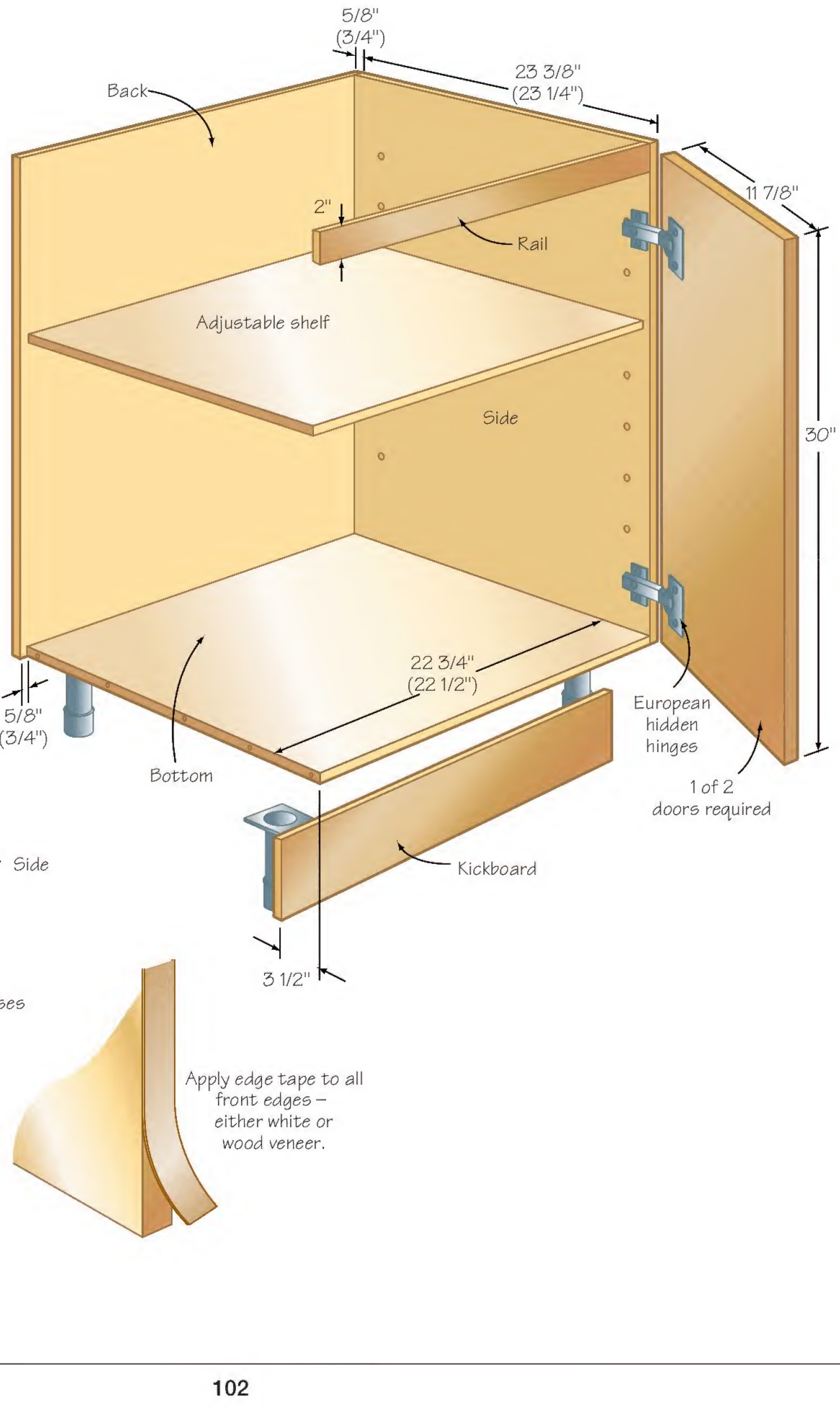
2 Drill holes for the adjustable shelf pins. These holes can be drilled using the homemade jig shown on page 36. Shelf hole spacing is a matter of personal taste; however, I normally space them 1¼" on center.

If you plan to install pullout shelves in the base cabinets, the holes for adjustable shelves aren't required and you can skip this step.

24"-WIDE FRAMELESS BASE CABINET







* 3/4"-thick material dimensions in parentheses

3 Apply edge tape to the exposed edges of the sides, bottom and underside of the top rail. The easiest tape to apply is heat activated. Trim the excess edge tape after ensuring it is firmly cemented to the board. Use an inexpensive hand trimmer to remove the excess tape on the sides. This task can be accomplished with a sharp file or knife. I've had the most success with a hand trimmer that costs about $20, found in most home stores.

4 **LEFT** Secure the sides to the bottom board as shown. Use 2" screws designed for particleboard joinery. The lower edges of the sides are aligned flush with the bottom face of the bottom board. Space the screws about 6" apart and always predrill and countersink the screw holes.

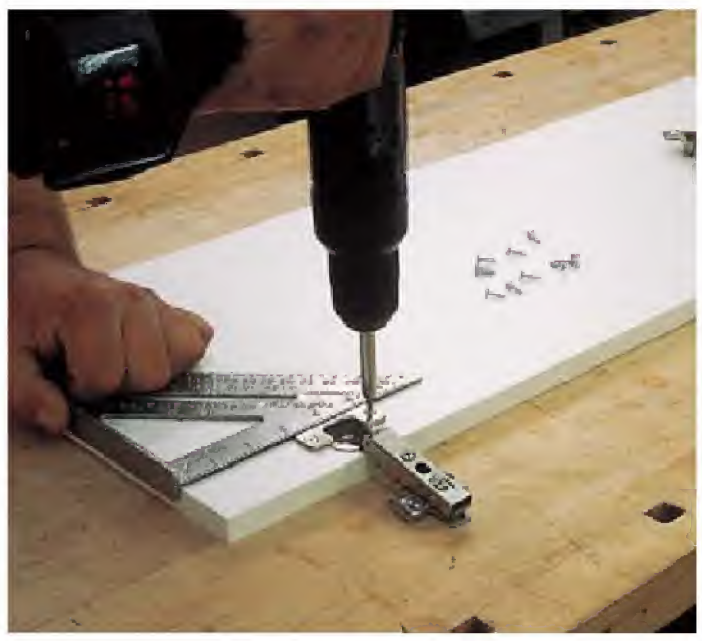
5 **ABOVE** The back is attached with 2"-long PB screws about 6" apart. Measure the actual width of the bottom board, plus the two sides, then cut the backboard width to that measurement. Remember, the backboard was cut ⅛" wider to account for any thickness differences in your material.

Ensure the backboard is flush with the top back edges of the side boards, the bottom edge of the base board and the outside edges of the side boards. This board will strengthen and square the cabinet.

6 **BOTTOM LEFT** Secure the 2"-high rail to the base cabinet, flush with the top edges of the side boards. Install one 2"-long screw per side in predrilled pilot holes.

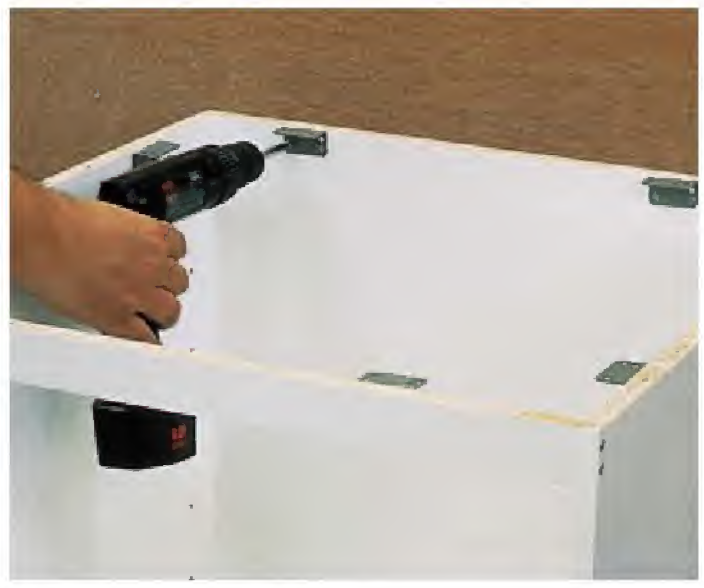
These screws are close to the edges of the rail and it could split. The common practice, when joining particleboard material, is to keep screws at least 1" away from a board's edge. Drive one 2" screw at the center point of the rail and secure the back, on each side, with a right-angle countertop bracket. These brackets will be discussed later in this section.

7 Attach four adjustable legs, one per corner, 3½" back from the front edge. Secure them with ⅝"-long PB screws so they support the side boards. At one time these legs were attached with a long bolt through the bottom board. However, many people use four ⅝" screws because the legs can be easily moved, and cover caps are no longer needed to hide the bolt heads inside the cabinet.

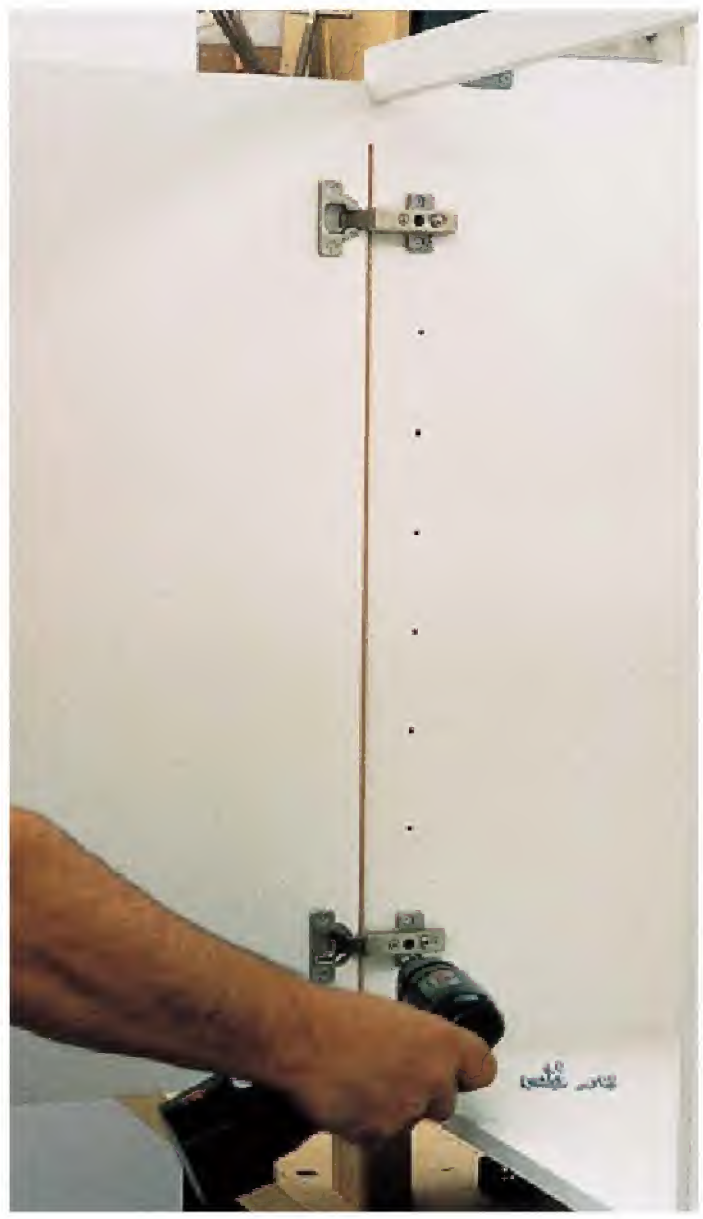


10 Screw the hinges in place with the hinge plates attached. I am using Blum 100° clip-on full-overlay hinges on my cabinet. The hinge is properly installed when it's 90° to the door's edge. Use a square to align the hinge when inserting the screws.

12 **LEFT** A baseboard can be installed after the cabinet is secured in place. If this cabinet is a stand-alone, you should inset the legs 3½" on each side. If the cabinet is in a run, you have to inset only the outside units to secure the baseboard. Kickboard clips are attached to the baseboard. These metal clips slip on the leg shafts and hold the board securely. On stand-alone or end-of-run cabinets, where the end of the front kickboard is exposed, edge tape must be applied.



8 Install eight countertop brackets, two per inside face, on the sides, back and rail board. These are secured with ⅝" PB screws and aligned flush with the cabinet's top edge.



9 Edge-tape the doors with iron-on tape. Drill two 35mm holes in each door, ⅛" back from the door edge and 3" on center from the bottom and top. These holes will be used to attach the hidden hinges.

11 **LEFT** It's easy to guarantee perfect door placement using this simple installation method. First, cut a ⅛"-thick spacer. Then place the door in its normally open position, making sure the vertical alignment is correct. Place the spacer strip between the door and cabinet side edge. Insert screws through the hinge plate and into the cabinet side board. After both hinges are secure, remove the door from the hinge plates and install the screws in the plate that are hidden by the hinge. Reinstall the doors and adjust if necessary.

Notice that I've placed a block under the cabinet. The cabinet bottom and door rest on this block so it will be held flush with the lower side of the bottom board while I attach the door.

13 Shelf supports and the shelf can be installed at this point to complete the cabinet.

Drawer-Over-Door Frameless Base Cabinets

Drawer-over-door frameless base cabinets are commonly used for sink bases and in instances when a drawer, as well as storage space behind doors, is required. It's a common style of kitchen cabinet that is often preferred over the standard full-door unit.

This cabinet is built following the same steps used to build a standard frameless base. The only added step is the installation of a second rail. This rail is installed below the top rail with a 6" space between them. However, that's not a hard design rule, so any height drawer space is fine.

The rail is needed for the top edges of the doors, as they require support in the center of a two-door cabinet. The rail doesn't have to be installed in narrow, single-door cabinets because each side of the door closes on the cabinet edges.

The 6" space means the drawer box is 5" high, because it's 1" less in height than the space. The drawer face is normally 1" higher than the space and 1" wider. The combination of drawer face plus door heights, and the space between them, should

equal the overall height of your full-height doors. If I use 30"-high doors, I install a 7"-high drawer face, a door below at $22\frac{15}{16}$" high, and a space between them of $\frac{1}{16}$" to match the full door height.

The drawer box is installed using the European bottom-mount drawer glides. The drawer-glide runners are mounted to the drawer box and cabinet sides, so no other support is required.

End-of-Run Frameless Cabinets

Any cabinet that will have its sides visible can be covered with a panel. Often a door is used as an end panel. Veneer is also an option, or a sheet material that has wood veneer on one face and melamine on the other.

If you use veneer particleboards or plywood, the ends don't have to be covered. But a hidden joinery system for those visible cabinet sides is required. The best joinery method in this situation is a biscuit joint.

Wood-Styled Frameless Cabinets

White melamine frameless cabinets can have wood surfaces and doors. In fact, this is a common application for large kitchen cabinet manufacturers.

Decide on the wood species you wish to use. Substitute melamine rails with hardwood in the base cabinets. Apply wood-veneer edge tape to the exposed cabinet edges and any exposed sides. Then use wood doors in place of the melamine doors. All visible surfaces will be covered with wood veneer and solid wood, but the cabinet interiors will be melamine.

Wood veneer is available in large sheets with heat-activated glue. The sheets are pressed in place with an iron, rolled flat and then trimmed. As mentioned previously, you may be able to find particleboard with both wood veneer and melamine faces on opposite sides. If not, veneer particleboard or plywood can also be used to build your frameless cabinets.

Drawer-Bank Frameless Base Cabinets

A drawer-bank base is constructed following the procedures for building a standard frameless base cabinet. These cabinets have only one top rail because the drawer faces rest against the cabinet side front edges. The drawer faces are spaced ⅛" apart, and the total height of drawer faces and spaces should equal a full door height.

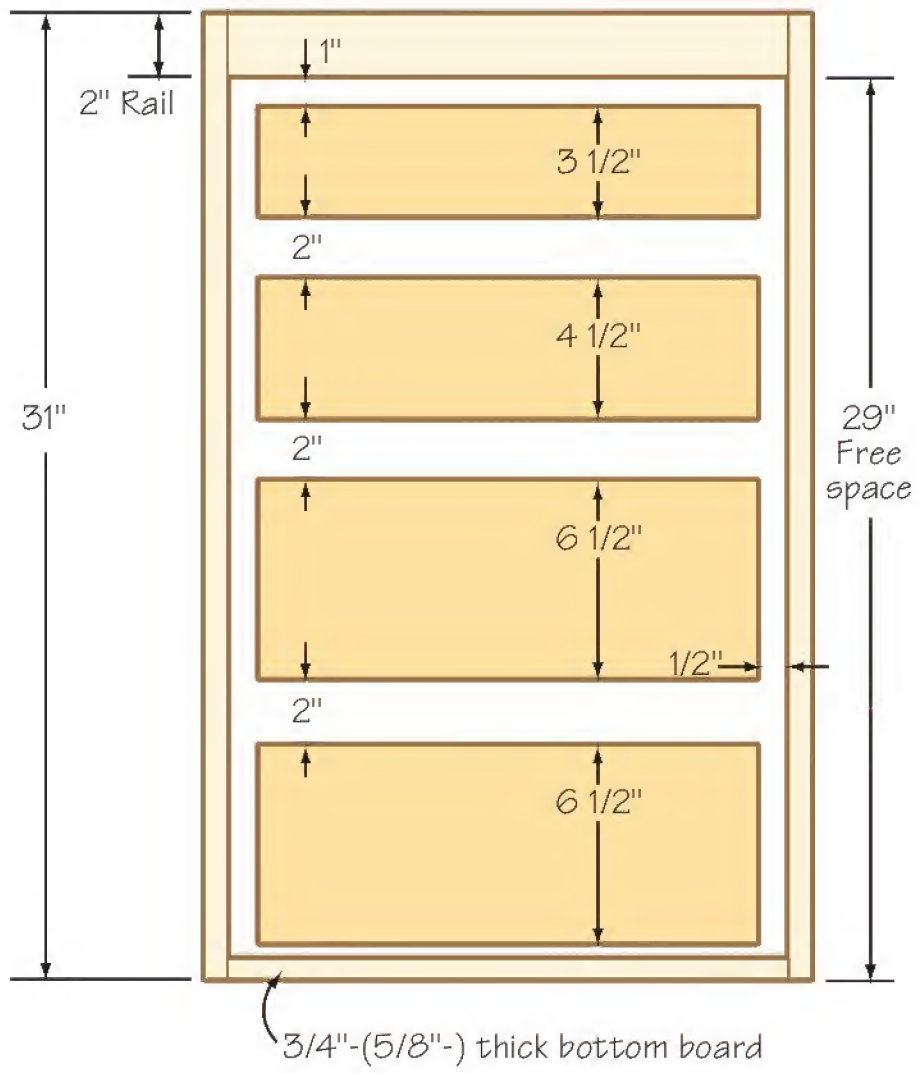
Follow the steps outlined in the technical drawing when building a three- or four-drawer base cabinet. The free space is measured from the bottom edge of the top rail to the lower face of the bottom board. Drawer boxes require 1" above and below for proper clearance, so subtract the necessary clearance total, depending on the number of drawer boxes you install, from the free space.

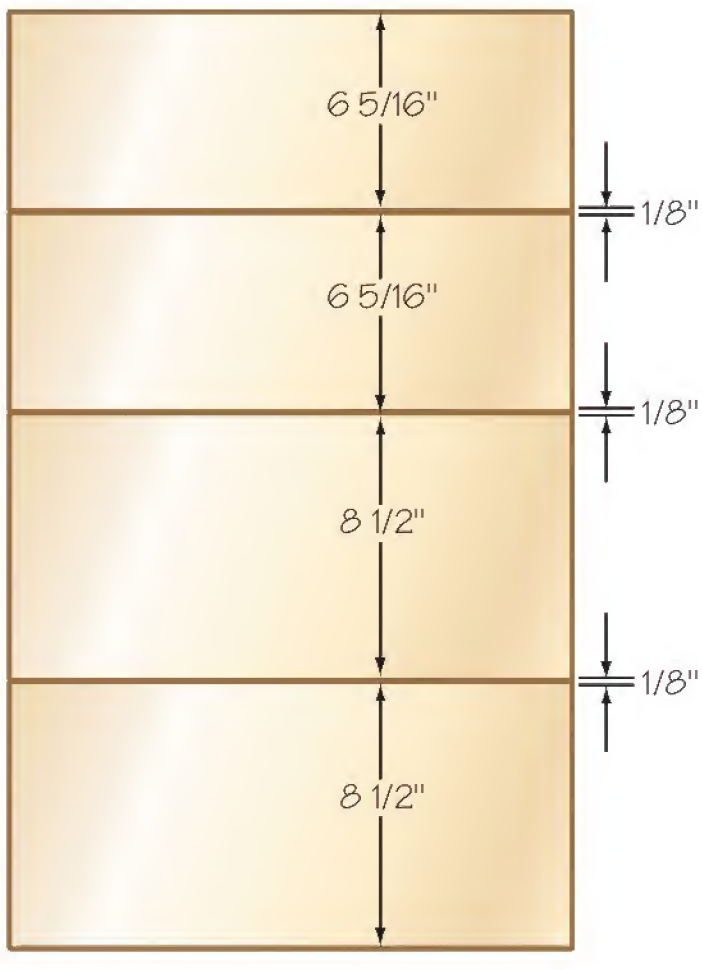
The usable drawer space can be divided into three or four drawer boxes of any size. You can follow the example in the drawing, use four 5½" drawer boxes for that usable space, or decide on any combination of sizes you require.

The two or three bottom drawer faces in the case of a three-drawer cabinet, are 2" higher than the drawer boxes. The top face is the sum of all lower faces plus spaces between, subtracted from a total door height, which in this example is 30".

CALCULATING FRAMELESS DRAWER BOX & FACE HEIGHTS

- Cabinet door height is 30".
- Drawer box width is free space minus drawer box clearance on each side.
- 29" minus 8" = 21" for drawer boxes.
- Decide on size of drawer box heights = 21".
- Drawer faces are approximately 2" higher than the drawer height except top face which is total drawer face heights subtracted from door height in use.

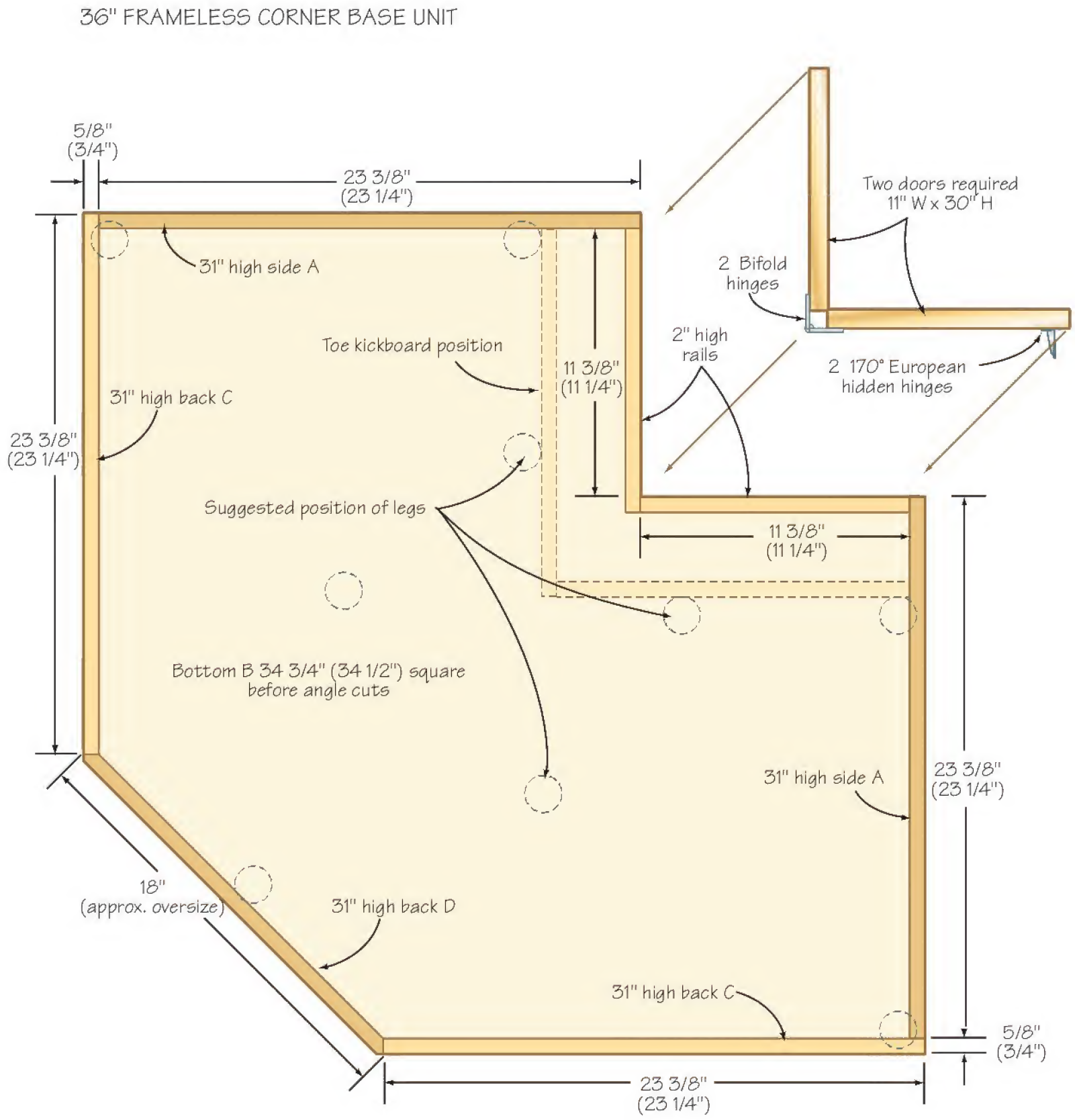




TOP DRAWER FACE HEIGHT

- 30" -(8 1/2") - (8 1/2") - (6 1/2") = top drawer face height, less 1/8" space between drawer faces (or 6 1/8" in this example).
- Design choice; make top two drawer faces 6 5/16" high to balance look.

Building a 36" Frameless Corner Lazy Susan Base



* Lazy Susan mounts in center of base and is supported on top by a cross brace attached by PB screws to the sides.

* 3/4" thick material dimensions in parentheses

The 36" corner lazy Susan cabinet makes excellent use of corner spaces in a kitchen. In many homes, the corner cabinets are dead-ended (called blind corners), and the space is wasted. This is a great way to recover and utilize corner space in your kitchen. This cabinet is usually fitted with a 32" pie-cut lazy Susan assembly.

The 36" corner base is a large cabinet, and a little more difficult to build when compared to a standard frameless model. However, follow the steps and your corner base will be perfect.

CUTTING LIST FOR A 36" (914MM) CORNER BASE CABINET USING 5/8" (16MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

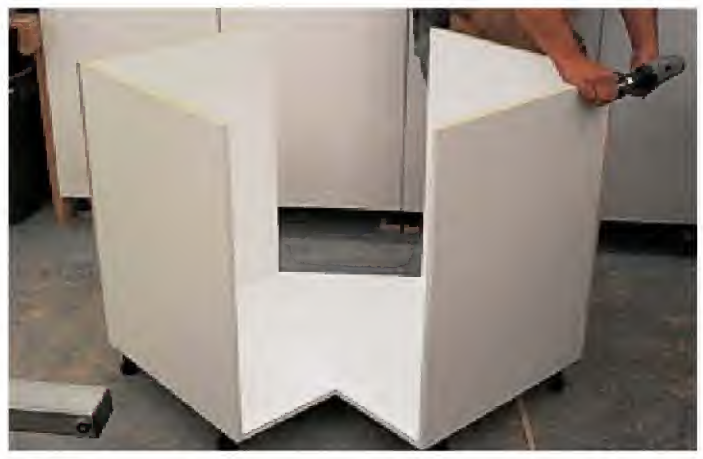
REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	5/8	(16)	23 3/8	(594)	31	(787)	
B	1	bottom	melamine pb	5/8	(16)	34 3/4	(883)	34 3/4	(883)	cut as illustrated in drawing
C	2	backs	melamine pb	5/8	(16)	23 3/8	(594)	31	(787)	
D	1	back	melamine pb	5/8	(16)	18	(457)	31	(787)	cut oversize, then sides are angle-cut at 45° to fit
E	2	doors	melamine pb	5/8	(16)	11	(279)	30-high	(762)	
F	1	rail	melamine pb	5/8	(16)	2	(51)	12	(305)	
G	1	rail	melamine pb	5/8	(16)	2	(51)	11 3/8	(289)	

CUTTING LIST FOR A 36" (914MM) CORNER BASE CABINET USING ¾" (19MM) THICK SHEET MATERIAL
INCHES (MILLIMETERS)

REFERENCE	QUANTITY	PART	STOCK	THICKNESS	(mm)	WIDTH	(mm)	LENGTH	(mm)	COMMENTS
A	2	sides	melamine pb	¾	(19)	23¼	(590)	31	(787)	
B	1	bottom	melamine pb	¾	(19)	34½	(877)	34½	(877)	cut as illustrated in drawing
C	2	backs	melamine pb	¾	(19)	23¼	(590)	31	(787)	
D	1	back	melamine pb	¾	(19)	18	(457)	31	(787)	cut oversize, then sides are angle-cut at 45° to fit
E	2	doors	melamine pb	¾	(19)	11	(279)	30-high	(762)	
F	1	rail	melamine pb	¾	(19)	2	(51)	12	(305)	
G	1	rail	melamine pb	¾	(19)	2	(51)	11¼	(285)	

1 The cabinet has six PB pieces as indicated in the drawing and in the cutting lists. Cut the pieces as detailed. Do not cut the angles on the 18" by 31" backboard D at this time. I recommend that you cut it with straight cuts to the stated 18" × 31" size. Draw the front notch cutout lines and back angle cut line on the bottom B. Use a table saw to cut the two front notch lines, pushing the board in until the blade is about 3" away from the corner of the notch. The bottom of your blade will undercut farther into the board and will weaken the cutout. Follow the same procedures for the other line. Use a handsaw or jigsaw to complete the notch cutout. Next, guide the two front corners of the cutout section against the table saw fence with the fence set to a width of cut that will travel the blade along the angled back cut line. Be sure that your fence is long enough so that both cutout corners are tight against the fence for the full angled cut.

2 Apply iron-on edge tape to the notch cuts, then install the cabinet legs in the positions as indicated in the drawing. Maintain the 3½" setback from the front edges of the cabinet. Remember that this setback is required for kickboard spacing on all the base cabinets. Position the other legs so they will extend out from the edge of the bottom board by ⅝" to aid in supporting the cabinet sides.



3 The front edges of the sides require edge tape before you start putting the cabinet panels together. Assemble the cabinet boards as shown, leaving the 18" × 31" backboard D until all others are secured. Use 2" PB screws in pilot holes, spaced every 8" on each panel. As well as securing the backs and sides to the bottom board, you'll also have to secure the backs to the sides with screws at each corner.

4 Measure the opening for the backboard D and fit it to the cabinet by cutting 45° angles on each side. It may be helpful the first time you build one of these cabinets to angle-cut the backboard so that it's a little larger, and trial fit the panel. Continue cutting the backboard slightly smaller after each trial fit until it's perfect.

Use 2" PB screws to attach the angled back to the bottom and backboards. Carefully site the screw line through the angled back and into the edge of the backs when drilling a pilot hole. It's a little difficult to drive screws at an angle, but take your time and drill the pilot hole accurately. Three screws on each side of the panel and two into the bottom board will hold it securely.

5 Cut both rails to the correct size and apply iron-on tape to the bottom edges. Secure the ends of each rail flush with the top edge of each cabinet side board using one 2"-long screw in the middle. Install right-angle brackets behind the rail to side board joints with ⅝"-long screws. Drive one 2" screw centered on the edge, 1" from the top of each rail, at the intersection of both rails.

The rail system is very weak at this point, so be careful not to lift on either rail. Once right-angle brackets are installed and both rails are secured to the underside of the countertop they will be well supported and secure.

6 Install the angle clips, two per panel, so the countertop can be secured.

7 **RIGHT** A board must be installed across the center of the cabinet to support the lazy Susan bearing assembly. This upper support is nothing more than a 4"-wide piece of ⅝"- or ¾"-thick melamine particleboard that's the same length as the baseboard. Secure it with two 2"-long screws through the cabinet side boards. If you have difficulty locating this board, wait until you're ready to install the lazy Susan upper bearing support and locate it directly over the bearing.

8 The door sizes on this cabinet are special. The 1"-plus rule doesn't apply here, so we use a calculation of notch length minus ¼" (for ¾"-thick material) or minus ⅜" (for ⅝"-thick material) for the doors. These two doors will have special hinges. First, drill 35mm-diameter holes in one door, following the standard steps for hinge hole positioning. These cabinet doors require 170° hinges, but they cannot be installed with a ⅛"-thick spacer. The wide-opening hinge plates are properly aligned on the cabinet sides by temporarily installing a standard 100° to 120° hinge on the doors.

9 One of the two doors that have 35mm-diameter holes for the wide hinges will also need hinge holes drilled on the opposite edge of the door for bifold hinges. These special hinges secure the two doors to each other. The holes for the bifold-type hinges are drilled so the center of the 35mm hole is 12.5mm from the door's edge. That position will create a ¾" hole in the door, which is required for these hinges.

10 Follow the hinge and door mounting steps using the standard-opening hinge. Once the plates are properly located, switch the standard-opening hinges with the 170°-wide hinges. They will be attached to the hinge plates already mounted on the cabinet sides.

The bifold hinges that join both doors are installed following the directions supplied by the manufacturer. After installing the doors, follow the installation directions supplied with the lazy Susan assembly. Make sure it's properly positioned so the hinges don't run against the revolving shelves or affect door operation. The cabinet is now ready to be installed.

countertops

The simplest and least expensive approach in a renovation project is to use one of the many styles of roll or postformed laminate countertops that are readily available. Laminate is applied under pressure over a particleboard form that has a curved, moulded backsplash and front edge. It is relatively inexpensive and available at one of the many countertop specialty companies in most major cities.

If you're building a great deal of custom cabinetry, you might have some problems with postformed tops, as they are fairly standard in size and design. However, this style can be used for the majority of projects.

Postformed countertops are usually sold by the running foot. You can get bartop countertops, island tops and preassembled or assemble-yourself angled tops. Most countertop suppliers will cut and assemble right-angle countertops, including ones that go from a standard countertop to a bartop on a peninsula.

If possible, have the supplier assemble the right-angle runs, as they seem to produce a better joint in their shop than can be achieved on the job site. Suppliers have roll countertop designs called bullnose, flat-top, traditional, etc., and countertop styles such as bartop, regular and island. Finish materials are numerous and varied from manufacturers such as Wilsonart, Formica and many others. Costs are reasonable and they can supply countertops for most of your needs.

Countertop Material Options

SOLID-SURFACE MATERIALS

A popular material is the so-called solid-surface countertop, with product names such as Corian and Gibraltar. This can be an expensive alternative, and specialists trained by the manufacturers normally do installation. Not everyone can afford the luxury of this material, but you may find it fits within your budget. The demand seems to be increasing, and the cost is getting lower as more manufacturers enter the marketplace. Contact two or three of your local countertop suppliers and speak to them about their pricing schedule, product supply, sample material and literature.

CERAMIC TILE

Ceramic tile is used as a countertop material in some kitchen renovation projects. It is one of the oldest and most versatile materials. Available in many sizes, shapes and styles, this long-lasting and durable product can lend itself to many design applications. Ceramic tile is stain resistant and heatproof. However, the grout lines require constant maintenance due to the possibility of staining from food. It's best to seal the grout with a high-quality silicone sealer prior to use.

Ceramics are often used on the wall between the upper and lower cabinets because they are easy to clean. Application on the walls is a straightforward process and fairly simple as there are normally only three or four rows of tile to apply. Information on wall tile application is available at most tile specialty stores and is quite often a do-it-yourself procedure.

Countertop ceramic tile installation is also a relatively simple operation that requires a bit of skill and a lot of patience. Tile application over water-resistant plywood seems to work well with the proper glue and grout. Again, ask the experts at the tile center for the right combination with the product you purchase. Choose the tile, but remember to calculate the width of tiles and tile spacing before cutting your plywood to the correct size. With this method you can avoid a lot of unnecessary tile cut-

ting. Band the countertop edge, following tile installation, with a 1" × 2" hardwood strip to match the wood on your cabinets for a professional-looking finish. If you want to avoid a wood edge, you can purchase special edge tiles with a raised lip to complete the installation.

GRANITE

Natural materials such as granite, shown in the photo below, are becoming popular. The cost is toward the high end, often in the same range as solid-surface materials. It is a beautiful and long-lasting countertop option that you might want to investigate.

Granite is available in many colors, but not in as wide a range as the high-pressure laminates. The colors are natural, so you'll notice some variance in long runs, and from section to section, if your kitchen has a number of countertop runs. Stone is normally installed by specialists because of the training and tools that are required. Diamond cutting blades and heavy-duty polishing equipment are just a couple of the specialty tools required. Surprisingly, stone can break or be easily damaged if not installed properly, so the work is best left in the hands of professionals.

Building Wood-Edged Countertops

This countertop style is easily made and well within any woodworker's capabilities. The process involves attaching a wood edge trim to a panel, called the substrate, and covering the top with a high-pressure laminate.

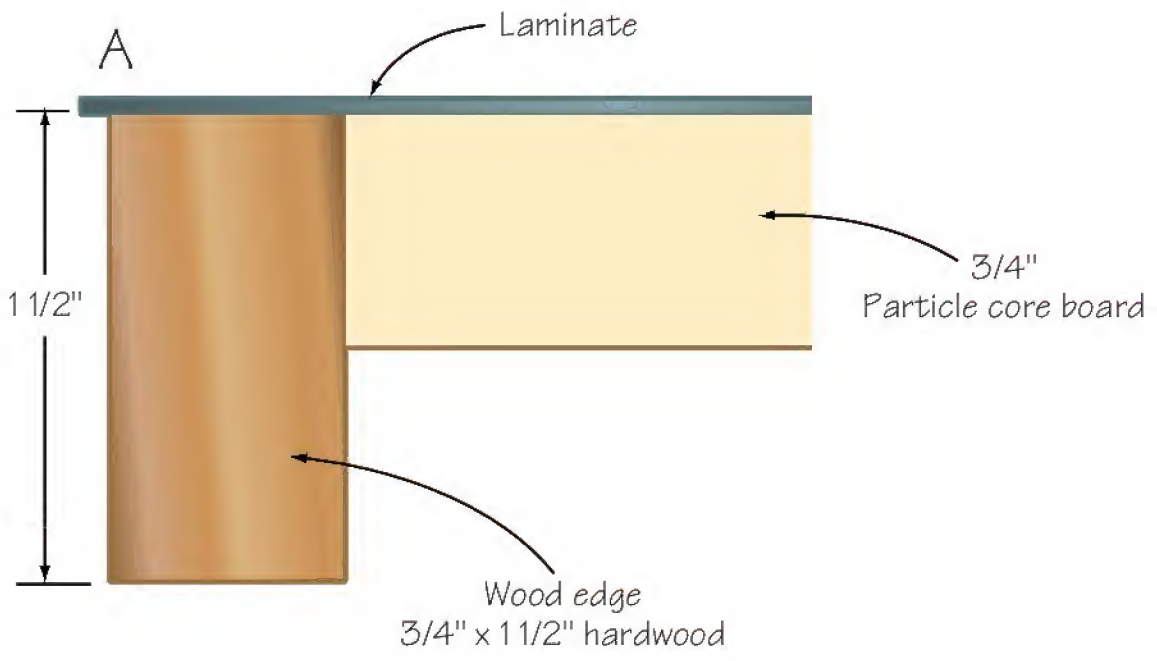
These laminates are made with decorative surface papers impregnated with melamine resins, which are pressed over kraft paper core sheets. These sheets are then bonded at pressures of 1,000 pounds or more per square inch, with temperatures approaching 300° F (149° C). The finished sheets are trimmed, and the backs are sanded to facilitate bonding. Most manufacturers have many patterns available.

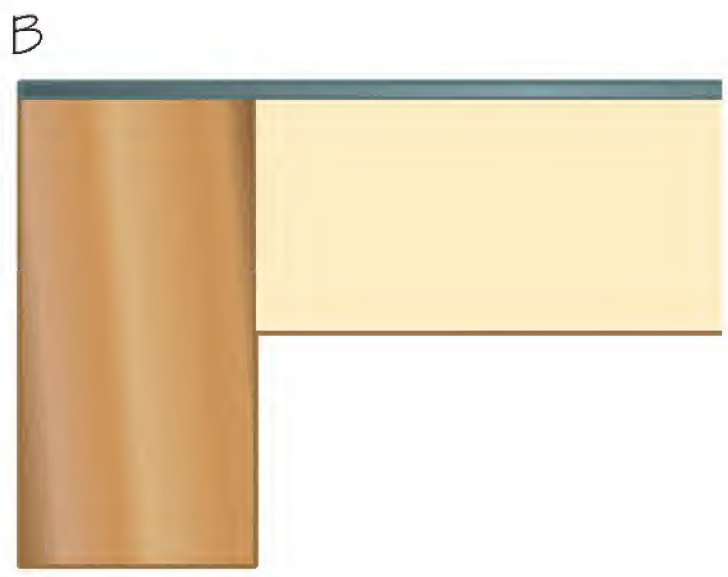
High-pressure laminate materials come in two thicknesses. The thinner version is used to manufacture postformed countertops that are common in almost every kitchen and bathroom. The thicker, general-purpose (GP) laminates are used for applications like the top in the photo at right. The GP material is able to stand more abuse because of its thickness.

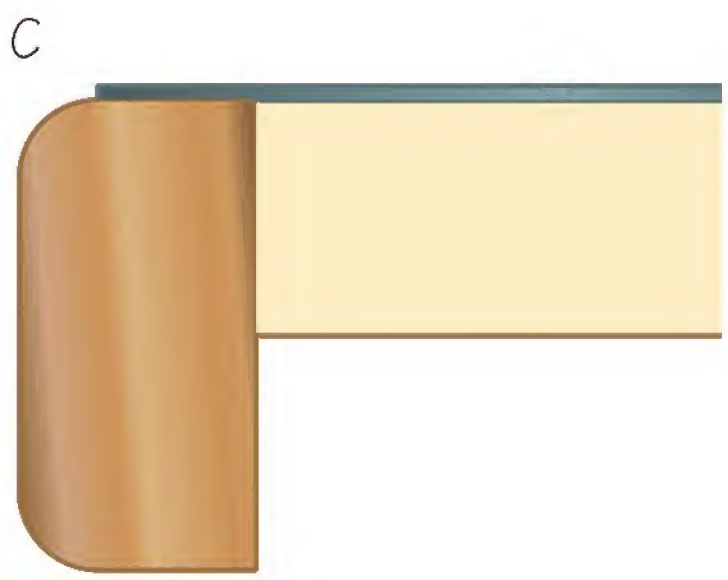
This great-looking wood-edged countertop style has a number of uses. It can be used as a kitchen or bathroom top, a work center/desk or as a utility countertop. I've used it in dozens of projects over the years. And, because the laminate is available in 4' × 8' or 5' × 12' sheets, most tops can be made without a seam.

You can use any stable sheet material as the substrate, including particleboard, plywood or medium-density fiberboard. I recommend a minimum ¾"-thick substrate for strength and stability. The wood edge can be any hardwood or softwood that complements your cabinets.

1 Cut the substrate sheet material to the required size. Reduce the desired finished size by ¾" where a wood edge will be installed. I am using ¾"-thick particleboard as my substrate for this top.







2 Attach the wood edge with glue and screws covered by wood plugs. You can also use dowels or biscuits. Any of these three options will work equally well. Be sure the top of the wood edge and the surface of the substrate are perfectly flush. If not, sand both to achieve a flat, smooth surface. This is a critical step, as the laminate won't bind properly to an uneven surface.

3 Cut the laminate 1" longer than the substrate on all edges. That extra width and length will allow for any slight positioning errors. Apply a contact adhesive to both the underside of the laminate and the substrate top. Make certain there's an even coat on both surfaces, and that all areas are covered. Many types of contact cement are available. I'm using a roller-grade liquid, but brush and spray contact cements are available at most home stores.

4 The contact cement is set when it's dry to the touch. Read the instructions listed on your container for best results. This adhesive will bond only to another surface with the same glue applied. Therefore, place dry sticks on the substrate to keep the materials from touching until the laminate is correctly positioned. Be careful: Once the two glued surfaces touch, they are bonded!

Remove the center stick and press the laminate in place with your hand. Move your hand from the center to the outside edges pushing out any trapped air bubbles. A pressure roller is the best tool to use to make certain the laminate is completely bonded to the substrate. If you don't have a commercial roller, use a wooden rolling pin or large wood dowel. Again, roll from the center to the edges, paying particular attention to the laminate edges.

5 The excess laminate can be cut flush to the wood edge using a flush-trim router bit. These bits have a guide bearing that tracks along the substrate and wood edges, cutting the laminate flush.

I'm using a small trim router; however, these trim bits will work fine in any router. Always verify that the bit is clean and the bearing is in good shape.

6 Use a roundover bit in a router to make a simple rounded profile on the bottom of the wood edge.

Cut the top or laminated surface of the countertop using the same roundover bit. Set the bit so its straight cutters, which are above the curved portion of the bit, cut slightly lower than the thickness of the laminate material. That cutting pass will trim the laminate cleanly and expose the wood under the laminate, as well as rounding over the top edge.

7 The wood edge and laminate profile should look like the end view shown in this photograph. Once all the cutting has been completed, sand the wood edge smooth and apply a finish.

Angled & Rounded Countertop Corners

If you have children running around, or desire a softer look, the substrate can be angle-cut, fitted with 1" × 2" wood banding and sanded round prior to laminate installation and routing.

The edge trim and roundover bits will follow the wood-edged profile and cut the laminate to almost any shape. The wood-edged tops can be cut into many shapes to meet your requirements. It's a flexible style of top that's easily customized.

Installing a Backsplash

Backsplash material is normally 1×3 hardwood of the same type as the cabinet wood. Attach the backsplash material to the wall with screws in countersunk holes. Cover the holes with wooden buttons, or attach the wood edge to the top with 1½" screws, from the underside, before the countertop is installed. It's also good practice to run a bead of clear silicone between the wood backsplash and laminate to seal the joint.

Island Countertops

Island countertops have four exposed counter edges and are usually a custom width. These top styles can be ordered from the supplier, or you can use the custom wood-edge style. Bartop, island and peninsula cabinet systems are becoming more and more popular as people tear down walls to create open-concept homes. Base cabinets with fancy tops are created as room dividers, providing workspace but maintaining an open feeling. Many of my new kitchen projects use the island and peninsula concept to add excitement to newly created spaces, simply by removing a wall.

Construction Notes

Using general-purpose laminate, which is a thicker material, will provide you with a durable countertop. However, use care when cutting to avoid damaging the laminate. The best router bits are carbide tipped and work exceptionally well for this application.

The wood edge in my case was oak, but any species can be used. Stick with the major brands of laminate material for the best results. High-quality material and contact cement will give you perfect results every time.

Some of the adhesives are toxic, particularly the petroleum-based products, so work in a well-vented area. And make sure you closely follow the application directions from the adhesive manufacturer, because heat range and humidity levels are important when using these products.

cabinet doors & drawers

As most cabinetry is for storage, doors to hide the spaces and drawers to ease in access are important parts of an attractive and functional storage cabinet. There are a variety of styles available and I have tried to show most of the major options available here.

Flat Panel Doors

Slab or flat panel doors are the simplest form of cabinet doors. In most cases, they are made using sheet materials such as veneer plywood or particleboard (PB), melamine PB, medium-density fiberboard (MDF), or solid-wood glued-up panels.

These flat panels can be edge-taped with a matching material, solid-wood edged, or formed when the edges are solid material. Because these doors are flat, mouldings can be applied to create visual interest or a pattern can be routed into the face. In many cases, slab doors made with materials like MDF can be painted.

They are relatively inexpensive because a 4' × 8' sheet will yield quite a few doors. However, because they are flat they can look plain but we can add some interesting details with mouldings and decorative scroll pieces. Designs can be cut into the face of solid-wood panels and MDF sheet stock using the pattern-routing jig described at the end of this chapter.

There are dozens of ways to make panel doors and just as many ways to add detailing. I'll show you a few in this chapter with some of the sheet stock material that's available. Doors are the most expensive part of any cabinet project, so using sheet material is one way to keep the cost at a reasonable level. And with a little imagination — using paint, designs, mouldings and routing techniques — slab doors can add a great deal to the overall look of your cabinet project.

Melamine PB Doors

Melamine PB doors are typically flat doors cut from a sheet of 4' × 8', ⅝"- or ¾"-thick melamine particleboard. They are low-cost doors because a sheet will yield quite a few doors at about $1 per square foot. The edges are finished with iron-on tape that is available in many colors to match the sheet stock. White melamine PB is the most common sheet material on the market.

These doors have many uses, such as for workshop and laundry room cabinets or for basic storage cabinetry in your home. The colored sheets can be used to create work and storage cabinets for children's rooms or in a basement playroom.

1 Cut the melamine sheet material to the door size required and apply tape to all exposed edges. The most common edge tape available has an adhesive back, which is activated with an iron. Be sure to roll the tape when the glue is hot to achieve full edge contact.

2 Trim the edge tape to the board thickness with a two-sided edge trimmer, sharp chisel or knife.

3 Dress the edges with a laminate file, removing any portion of the tape that extends past the board's face. A smooth surface between edge tape and door face will help prevent damage to the tape.

Veneer Slab Doors

Veneer-slab doors can be made using veneer-covered particleboard or plywood sheet material. The construction steps used to build this type of flat panel door are much the same as for melamine PB doors. Wood-veneer tape, which matches the face veneer, is used to dress the panel edges. However, there are special cutting techniques that must be used when edge-dressing the tape.

1 Apply the wood-veneer edge tape using an iron to activate the adhesive. Roll the tape as it's heated to ensure a good bond between the tape and board edges.

2 Wood-veneer edge tape is real wood as the name suggests. It has a wood species — oak, for example — and a grain structure that tends to split along the grain line when trimmed with a knife. Using a router and flush-trim router bit with a guide bearing helps to ensure a clean cut without splitting the veneer.

3 Light passes with fine sandpaper can be used to smooth the tape edges. The edge between the tape and the board face, should be smooth to lessen the chance of tape damage.

Wood Edged Doors

Solid wood can be used to dress the edges of veneer-slab doors. It's a tougher edge treatment that opens up a few options not available with edge-taped doors. The solid-wood edge can be machined with a router using a roundover or chamfer bit to add a little more detail to these flat doors.

1 Cut the slab door to the required size less ½" on the width and length. Rip ¼"-thick solid-wood strips on the table saw and attach them to the door slab. Use glue and small brad nails to secure the wood strips. The first two strips are attached on opposite edges, aligning one end of each strip flush with the board end. Notice that I've cut the wood strips longer than the door length.

2 Set the table-saw fence to the panel length and trim the long ends of the wood strips. The strips will be perfectly flush with the panel ends.

3 Follow the same procedures, as detailed in step two, for the remaining two strips. Install and trim to length on the table saw. Use colored wood filler that matches the final door finish to fill the nail holes. Sand the wood edges smooth.

4 The solid-wood edges can be machined with a router. A roundover bit (shown in the photograph) or a chamfer bit are two common edge treatments for these doors, but there are many styles of bits that may be used.

Applied Molding Slab Doors

Veneer-core slab doors with taped or wood edges can be "dressed" up by adding mouldings. These are available at lumber yards and woodworking stores. There are dozens of patterns and styles that can be attached to the door

You can also buy intricate scrollwork patterns in wood that can be attached to slab doors. The same process applies; a little glue and a couple of brad nails are all that's needed. Or, if you have a scroll saw, you can make your own unique door-trim mouldings.

1 When applying mouldings to slab doors, the first step is to accurately mark the moulding position on your doors. This is important for achieveing a balanced-looking door.

2 Wood moulding can be attached to veneer doors using a little glue and small brad nails. Some mouldings are delicate, so they must be handled carefully.

Slid Wood Slab Doors

Solid-wood doors can be a nice addition to any cabinet project. Because they are solid, these slab doors can be machined using many more techniques than is possible with melamine or veneer-covered slab doors.

The process used to make solid-wood doors starts with the glue-up process of narrow boards to form a large panel. The edges of the narrow boards are machined straight and flat so all boards fit tight to each other. Usually a jointer is used to dress the boards, but a table saw may be used by following a few simple steps.

1 Edge-dressing narrow boards for solid-wood glued-up panels can be done on a well-tuned table saw. First, be sure the fence will tightly lock into place and is running parallel to the saw blade. The blade rotation must be smooth, without end play, to get the straight cuts on each board that are needed for successful glue ups. Rip one edge of the board; then turn it around, keeping the same face up, and rip the other edge. Both edges should be parallel to each other and at 90° to the board's face.

2 Remove small portions of the board's edge during each cut. Make sure that the edges are parallel with the board's face.

3 Test the boards by pushing them together on a flat surface. They should butt tightly to each other without a great deal of pressure. If necessary, repeat the edge-ripping steps until the boards fit together properly.

4 Apply glue to all the edges that are to be joined. Use clamps, alternating on the top and bottom, to bring the boards together. Don't apply too much clamp pressure or you will squeeze out all the glue and your joints will fail.

5 Use a panel crosscutting jig to square the ends and trim the door to its proper length. Then, rip the width to the correct size.

6 The edges can be machined with any bit profile, including a roundover in a router, as shown. You can also use profile bits such as a cove, ogee or chamfer to add visual interest to the door.

Frame and Flat Panel Doors

Traditional frame and panel doors (whether built with a flat or raised panel) are essentially built the same way, using five parts. Two vertical members of the door called stiles, two horizontal members called rails, and a center panel. With a flat-panel door, the center panel is usually veneer core plywood (no worries about wood movement), while a raised center panel will be solid wood.

As the construction is very similar, we'll start with the flat panel first, then follow with the raised panel.

The term "flat panel" refers to the plywood veneer center panel. The center panel of these doors isn't always ¼" thick plywood veneer. The two stiles and two rails are often joined in the same manner with sheet glass or decorative leaded glass center panels.

Corner joinery, or attaching the stiles to the rails, is the main concern with five piece doors. There are a number of methods using a table saw, router table, and mortising machine that can be used to form the joints. The steps are simple and straightforward but good woodworking practices must be used to produce solid frames.

This chapter will also deal with doors that have an arch or cathedral style cut on the top, bottom, or both rails. Making this style of door is a little more challenging but the procedures can be successfully mastered using simple geometry.

Construction Notes

The rail width equals the door width minus the stile widths. However, you also have to account for the tenon lengths on each end of the rail. A 12"-wide door with 2¼"-wide stiles requires a 7½"-wide rail, but you also need an additional 1½" for the tenons. The rough rail length before tenons are cut is therefore 9". With the ¾"-long tenons, ¾"-deep grooves and 2¼"-wide stiles, the rough rail length will always be 3" less than the door width. For example, using the same part dimensions, a 19"-wide door requires a 16" rail before tenons are cut — it's that easy when using the above combination of door-part dimensions. Center panel dimensions are easily calculated as well. The sample setup means the ¼" plywood panels will be 3" less than the overall door width and height. Therefore, the panel for a 12"-wide x 18"-high door will be 9" wide x 15" high.

Table Saw Tenon-and-Groove Doors

This style of door is made using a table saw only. The project door will be 12" wide by 18" high. The stiles and rails are solid 2¼"-wide solid wood, which are ¾" thick. The center panel is ¼"-thick veneer-covered plywood.

1 Cut the stiles and rails to the proper length. I normally use ¾"-thick × 2¼"-wide stock for my door frames. The rail tenons are ¾" long to match the grooves in the stiles. This combination of rail and stile width along with tenon length and groove depth makes it easy to calculate door-part dimensions. Each rail and stile needs a ¼"-wide groove that's ¾" deep, centered on one long edge. Cut the groove with a standard blade in two passes. Reverse the feed direction on the second pass to center the groove. Or, you can use a stacked dado blade set to cut a ¼"-wide slot centered on the edge of each part.

2 The tenons on both ends of the two rails are ¼" thick × ¾" long. They should be centered on the rail ends to fit the stile grooves. Tenons can be cut using a standard table-saw blade or a stacked dado blade. Cut a sample tenon and test-fit the assembly before forming the tenons on the actual rails.

3 The center panel is ¼" thick veneer plywood to match the rails and stiles. I'm using solid-oak wood and veneer plywood, but any species of wood may be used. The center panel is 3" less in width and height. My 12"-wide × 18"-high door requires a panel that's 9" wide × 15" high. However, I usually cut the center panel ⅛" less in width and height to allow for wood movement. Cut the panel to size and test-fit the door parts.

4 Assemble the door with glue on the rail tenons only. The center panel isn't normally glued in place, but left to float. Clamp the door, then measure the diagonals. If both measurements are the same, the door is square. If there is a difference, lightly tap the long measurement diagonal to equalize the dimensions before the adhesive sets up.

Router Table Tenon-and-Groove Doors

1 These doors are made following the same procedures that I detailed for the table saw. However, my slot cutter can only cut a groove that's ½" deep so the tenon dimensions will be reduced to ½" in length. If you have a wing or slot cutter that cuts at ¾" deep, use that length of tenon. Cut the rails and stiles to length, then rout a ¼"-wide × ½"-deep groove along one edge of each part. Be sure to center the grooves on the rails and stiles. My slot cutter will only cut a 3/16"-wide groove, but I want a ¼" groove. If you have a tool that won't cut the full width, set the bottom edge of the cutter ¼" about the router table surface. Make the first cutting pass, then flip the wood and make a final pass. The groove will be ¼" wide and centered when using ¾"-thick stock.

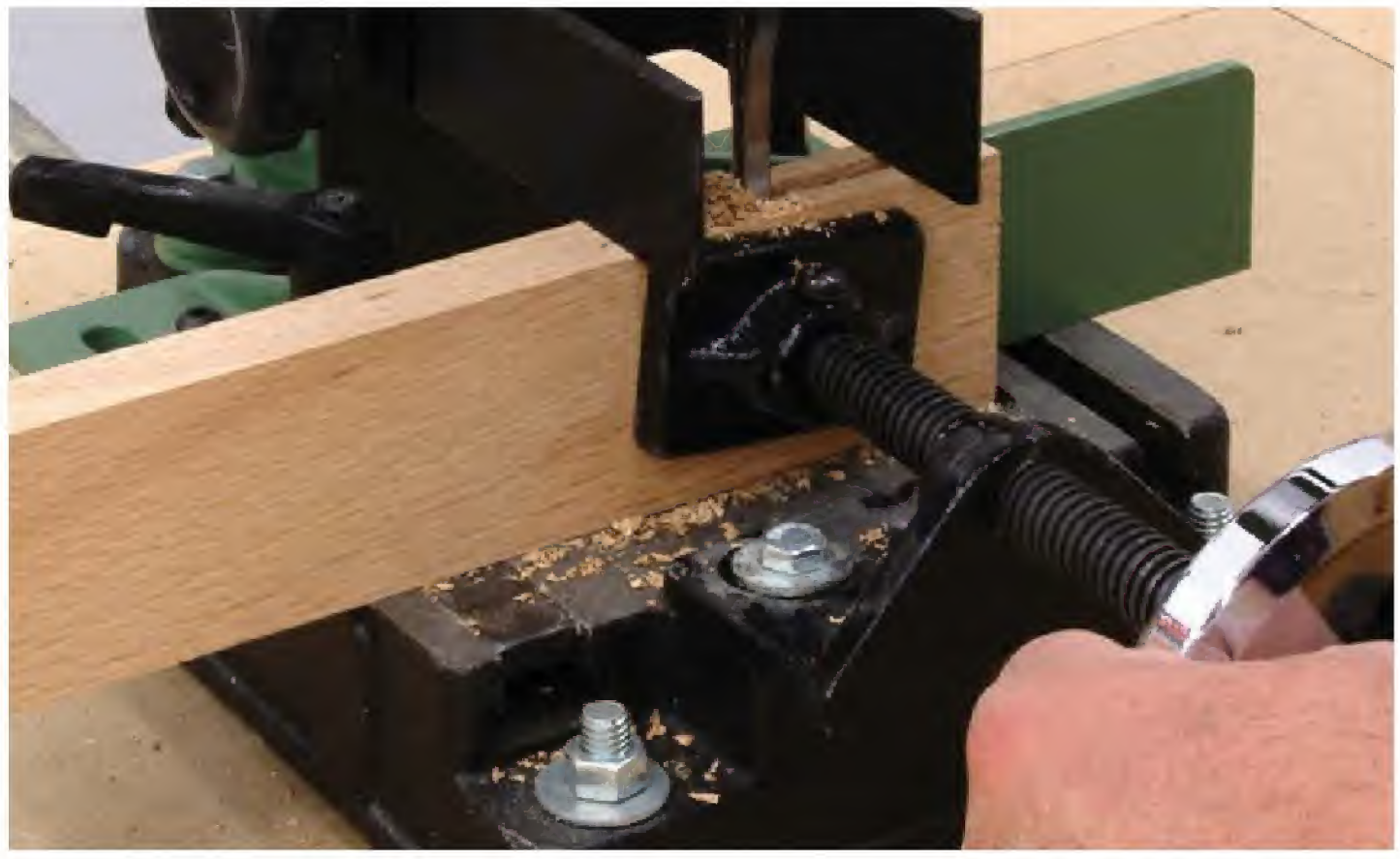
2 Replace the slot bit with a ½" router bit to cut the rail tenons on each end. Once again, use a test piece of wood to center the tenon and verify its proper thickness. The tenons should fit snugly into the rail grooves without distorting the sides of those grooves. A loose fit will result in the joint failing, while a tight fit will put stress on the groove walls and may split the stile.

3 Cut the ¼"-thick center panel to the correct size and test-fit the door assembly. Once you are satisfied with the fit, apply glue to the tenons, install the center panel, and clamp until the adhesive sets up. Remember, the panel's width and height should be ⅞" greater than the inside dimension of the door frame because the grooves are ½" deep in my case. The panel should have a little space to allow for wood movement of the stiles and rails.

Construction Notes

There are many edge options that you can use to add visual interest to your doors. Most are easily formed with router bits, including the cove, roundover and ogee. However, there are dozens more profiles, so experiment with a few until you find one that suits your taste. A word of caution when adding profiles, the combination of door profile and hinge style may present a problem (European hinges rest in holes that are about ½" deep and ⅛" away from the door's edge, while traditional hinges, such as butt or piano hinges, require a full-thickness edge to be properly installed). So Always test a profile cut on scrap lumber, then mount a sample hinge to determine if there will be proper clearance and sufficient material left for the hinge hole.

Mortise & Tenon Doors



Door frames can be built using mortise-and-tenon joinery. Tenons are cut on the ends of each rail and a mortise is formed in the stiles. This is a traditional joinery option that is still widely used.

The tenons may be cut by hand, on the table saw or on a router table, and the mortises formed with a drill press and chisel. I will be using a dedicated mortiser to cut my tenons because that's the method I prefer. If you use mortise-and-tenon joinery a lot, a dedicated mortiser would be a good investment.

1 Cut the two stiles and rails to size to build a 12"-wide × 18"-high door. The stiles should be 18" high and the rails 9" wide when you're using 2¼" wide stiles and rails with ¾"-long tenons. The stiles need a ¾" deep mortise that's 1¾" long in the center at each end. Start all the mortises ½" from each stile end. As mentioned, if you don't own a dedicated mortiser, drill a series of holes and clean out the waste with a sharp chisel to square the holes.

2 Form a ¾"-long × ¼"-thick tenon in the center of each rail end. The top outside ½" of the tenons are notched so they will fit in the stile mortises that begin ½" from each stile end. The tenons can be notched after they are cut to size with the same saw setup.

3 If you plan on cutting rabbets on the back face for a glass panel, brush glue on the tenons, then assemble the door. The door frame's back face needs a rabbet cut to hold the center panel. Glass, veneer plywood, or any type of decorative panel may be used. The rabbet is cut with a router bit called a slot cutter. It's equipped with a guide bearing that will follow the inside perimeter of the frame. You may need to make a number of passes with the slot cutter to achieve the desired rabbet depth. That depth will depend on the thickness of material used for the center panel. If you want a centered wood panel, use the same slot bit to cut the grooves. As stated before, my slot cutter is only 3/16" thick, so I have to make two passes. Moreover, it only grooves ½" deep, so my center panel for this 12"-wide × 18"-high door will be 8⅜" wide × 14⅜" high, which leaves a little space for wood movement. Once the cuts for the panel you want to install are completed, glue and clamp the frame.

Arched Doors

Cutting curves, arcs and other radius patterns in rails is a little more difficult than cutting a straight-rail door. There are patterns for arched doors that can be purchased at woodworking stores. However, a little bit of simple geometry and an understanding of how the arc is varied based on door width will allow you to make your own patterns.

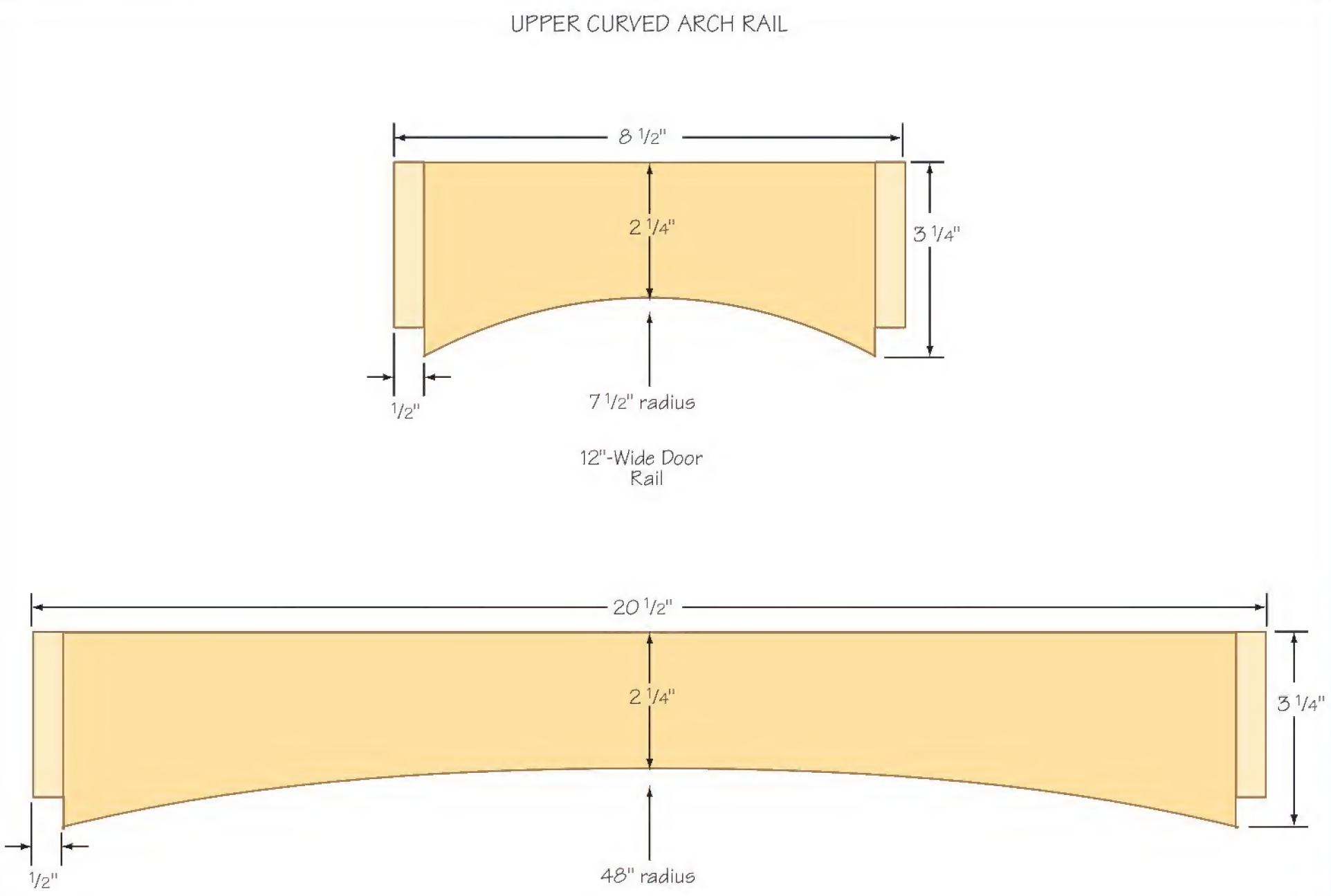
The arched door has a curve cut into the top rail and is referred to as an arched frame-and-panel door. I'll explain how the top rail can be cut to form a cathedral-style door later in this chapter. The important issue to remember is that kitchen doors vary in width. The challenge is to maintain a visually consistent appearance among all the doors in the room, no matter what width. To accomplish this, all curves in each door must follow certain rules. I'm using 3¼"-wide upper curved rails for this example.

The straight stiles and bottom rail are 2¼" wide in my design. So, to maintain a consistent appearance between a door that's 12" wide and one that is 24" wide, I need a constant reference point on both doors. I can achieve a consistent look among all my doors by making sure my arc is 2¼" down from the top center of all the curved rails — no matter the door width. All my doors will have the same measurement above the arc and only the radius of the arc will change.

The drawing illustrates the differences between rails for a 12"-wide door and a 24"-wide door. Only the rail width and arc radius change; all other values remain the same. The start and end of each arc is at the point where the rail meets the stiles. In addition, there should always be 2¼" of solid wood above the center of each arc.

Starting and ending the arc at the same place on doors of different widths, as well as maintaining the 2¼" measurement above the arc, will make all the doors appear similar. Changing those fixed points as the width changes would dramatically change the door's appearance. You can verify these design principles by measuring different arched doors of different widths in any typical kitchen.

For detailed calculations on how to determine the radius of an arc for any door, refer to page 131.



Arched Frame & Panel Doors

1 This example door is 12" wide and 18" high. I'm using ¾"-thick stock for the stiles and rails with a ¼"-thick veneer plywood panel. All stock used for the doors is ¾" thick. Cut two stiles at 2¼" wide × 18" long and one upper rail at 3¼" high × 8½" wide. The bottom rail is 2¼" high × 8½" wide. Note that the width of the upper and lower rails includes a ½" long tenon on each end. Cut the tenons on both rails. All the tenons are ¼" thick × ½" long and are centered on the rail ends. A stacked dado head cutter on your table saw is the best tool to form these tenons.

2 Draw an arc on the wider upper rail, beginning and ending at each end and leaving 2¼" of wood above the arc at the center of the rail. I use an adjustable "yardstick" compass that's available at most woodworking stores. The arc will have a radius that is determined by the rail width (see page 131).

3 Cut the arc in the top rail using a band saw or jig saw. Leave the line visible when you cut and smooth the curve with a drum sander.

4 The grooves on the stiles and bottom straight rail should be ½" deep and ¼" wide. To cut the groove in the arched top rail I've used a wing or slot cutter in my router table. Door-frame parts are safely held, and routered, in my shop-made jig, detailed below. If your cutter is like mine, you'll need to flip the rail to get a ¼"-wide groove that will be ½" deep. The other parts grooved on the table saw are ½" deep as well.

5 The ¼" plywood center panel should be cut before beginning the door assembly. The simplest method of determining the correct arc for the center panel is to dry fit the door frame with the panel in the stiles and lower rail. I've left the panel long on top. Lightly trace the inside profile of your upper rail on the panel with the rail held 7/16" above the top edges of the stiles. Use a band saw or jig saw to cut the arc in the panel.

6 Dry fit the door assembly. Once all the parts fit properly without any undue force required, apply glue to the mortise and tenons. Clamp the door assembly and make sure that the door is square before the adhesive sets.

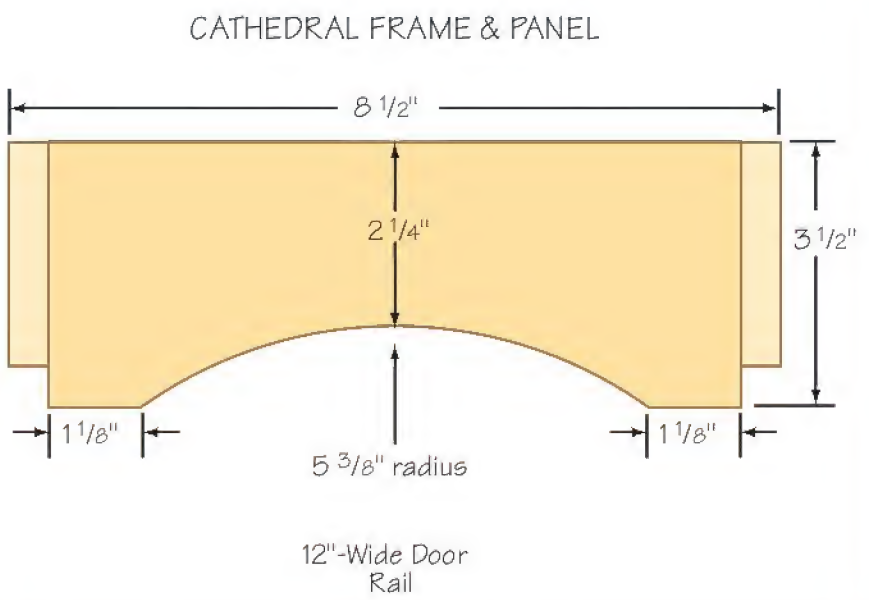
Cathedral Doors

The cathedral-style frame-and-panel door is a variation on the arched frame and panel. All the construction steps are identical except the design of the curved rail(s).

Prepare the stock as for the arched door style and cut the upper rail as shown in the drawing. The rail tenons are cut before the curve, so the flat edges on both sides of the rail can be used to guide the stock on the table saw.

In this design, dimension A, which is the width of the straight run at the ends of the rail, is one-half the stile width. The material above the arc, dimension B, on the rail equals the stile width. The arc radius can be changed by altering the width of A, but keep B equal to the stile width and the door will look balanced.

Maintaining A at half the stile width and B equal to the stile width means that the radius of the arc changes for different door widths. However, all doors used for the same project, such as a cabinet doors for a kitchen, will look consistent if dimensions A and B are identical on all the doors.

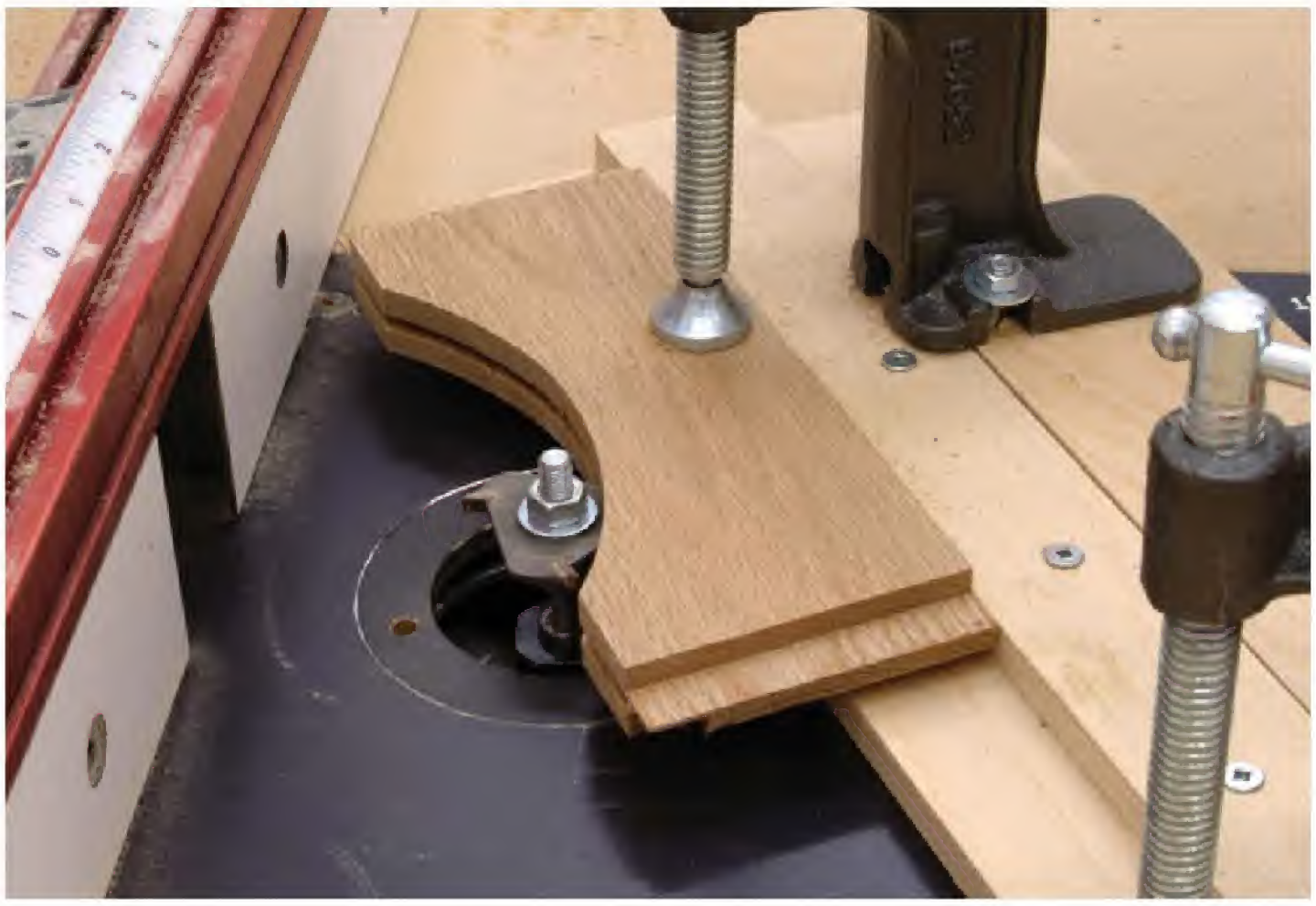


Cathedral Frame & Panel Doors

1 This example door is 12" wide × 18" high. I'm using ¾"-thick stock for the stiles and rails with a ¼"-thick veneer plywood panel. All stock used for the doors is ¾" thick. Cut two stiles at 2¼" wide × 18" long and one upper rail at 3¼" high × 8½" wide. The bottom rail is 2¼" high × 8½" wide. Note the width of the upper and lower rails include a ½"-long tenon on each end. Form the tenons on both rails using a stacked dado blade on the table saw. All the tenons are ¼" thick × ½" long and centered on the rail ends.

2 Draw an arc on the wider upper rail but remember to begin and end the radius 1⅛" short of each end as shown on the drawing. The arc will have a radius that is determined by the rail width (see page 131).

3 Cut the arc in the top rail using a band saw or jig saw. Leave the line visible when you cut and smooth the curve with a drum sander.



4 The grooves on the stiles and bottom straight rail should be ½"-deep × ¼"-wide. To cut the groove in the arched top rail I've used a wing or slot cutter in my router table. Door-frame parts are safely held, and routered, in my shop-made jig, detailed below. If your cutter is like mine, you'll need to flip the rail to get a ¼"-wide groove that will be ½" deep. The other parts grooved on the table saw are ½" deep as well.

5 The ¼"-plywood center panel should be cut before beginning the door assembly. The simplest method of determining the correct cathedral profile for the center panel is to dry fit the door frame with the panel in the stiles and lower rail. I've left the panel long on top. Lightly trace the inside profile of your upper rail on the panel with the rail held 7/16" above the top edges of the stiles. Use a band saw or jig saw to cut the profile on the panel.

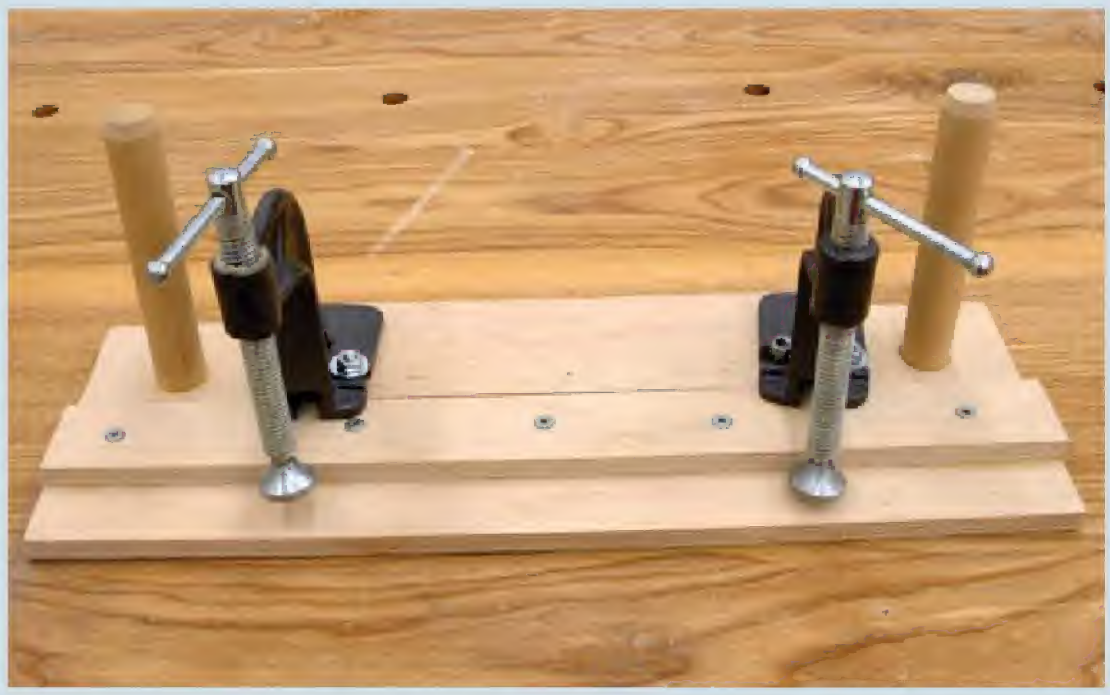
6 Dry fit the door assembly. Once all the parts fit properly without any undue force, apply glue to the mortise and tenons. Clamp the door assembly and make sure that the door is square before the adhesive sets.

Building a Curve Routing Jig

I'm not comfortable holding small curved pieces of wood when cutting grooves or profiles on the router table. My hands are too close to the cutter and have very little protection should the work piece jam or kick out.

I built this simple routing sled jig that clamps the work piece and provides handles that are well back from the router bit. It's easy to build as you can see from the picture. Use two pieces of ½"-thick plywood, one that is narrower than the other, and attach wood dowels for the handles and a couple of screw or toggle clamps. The hardware is available at many woodworking stores.

I like this jig because it lets me get a good, full grip, with both hands, to control



the work piece. If a problem does occur, I'm behind the work piece. You can see how the pieces of wood are clamped in the illustrations for building arched and cathedral doors.

Door Radii

The radius of an arc for arched and cathedral doors can be calculated mathematically. A line between two points on a circle is called a chord. The arc on both cathedral and arched doors is part of a circle, and the chord is the straight line between the arc ends that meet the bottom edge of the rail.

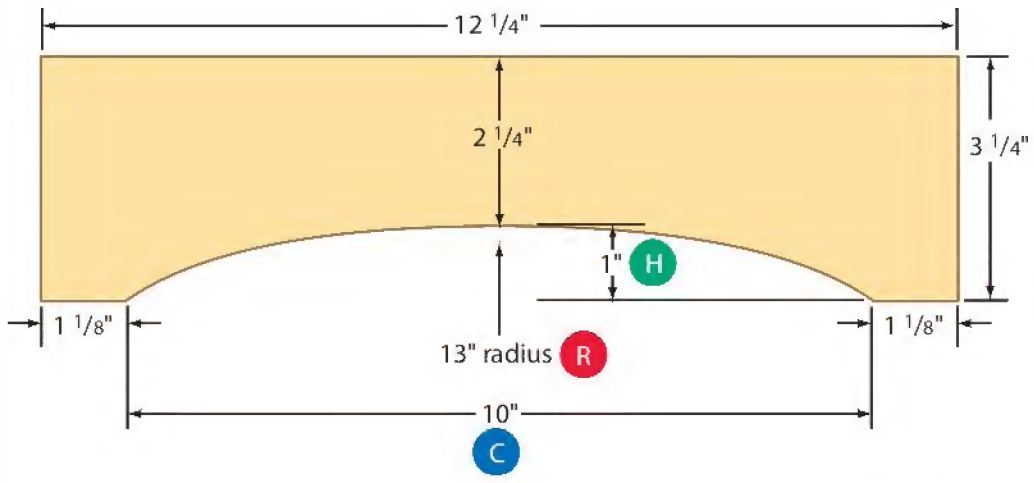
The formula states that the chord (C) is squared (multiplied by itself) and four times the height (H) dimension squared is added to that number. The number is then divided by a figure that is eight times the height. The result is the radius of the circle in inches and indicates the spread between point and pencil on a beam or large compass.

FORMULA:

$$R = (C^2 + 4H^2) / (8H)$$

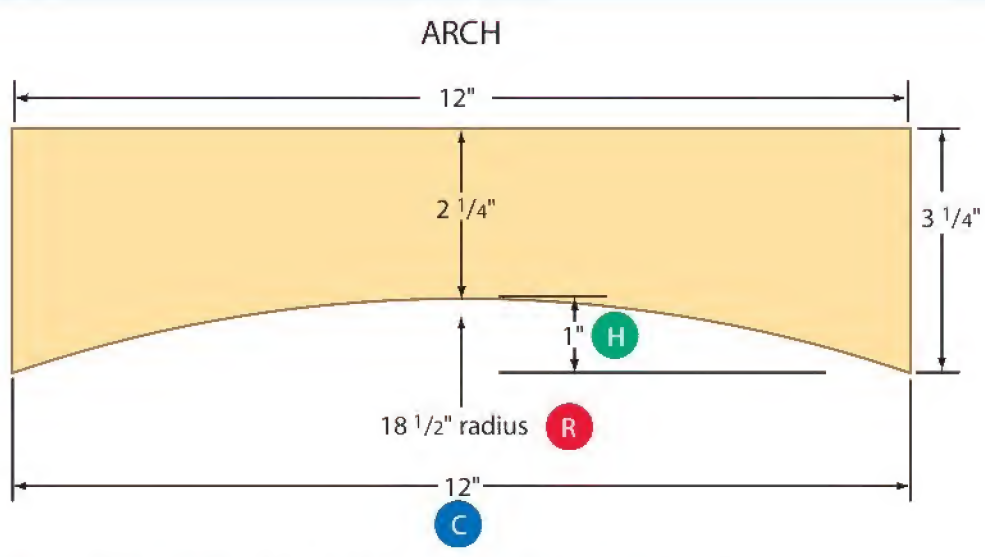
R radius C chord H height

CATHEDRAL



R = ([10 x 10] + [4 x 1]²) / (8 x 1) so, R = (100 + 16) / (8)
so, R = 116 / 8 and R = 14.5"

ARCH



R = ([12 x 12] + [4 x 1]²) / (8 x 1) so, R = (144 + 16) / (8)
so, R = 160 / 8 and R = 20"

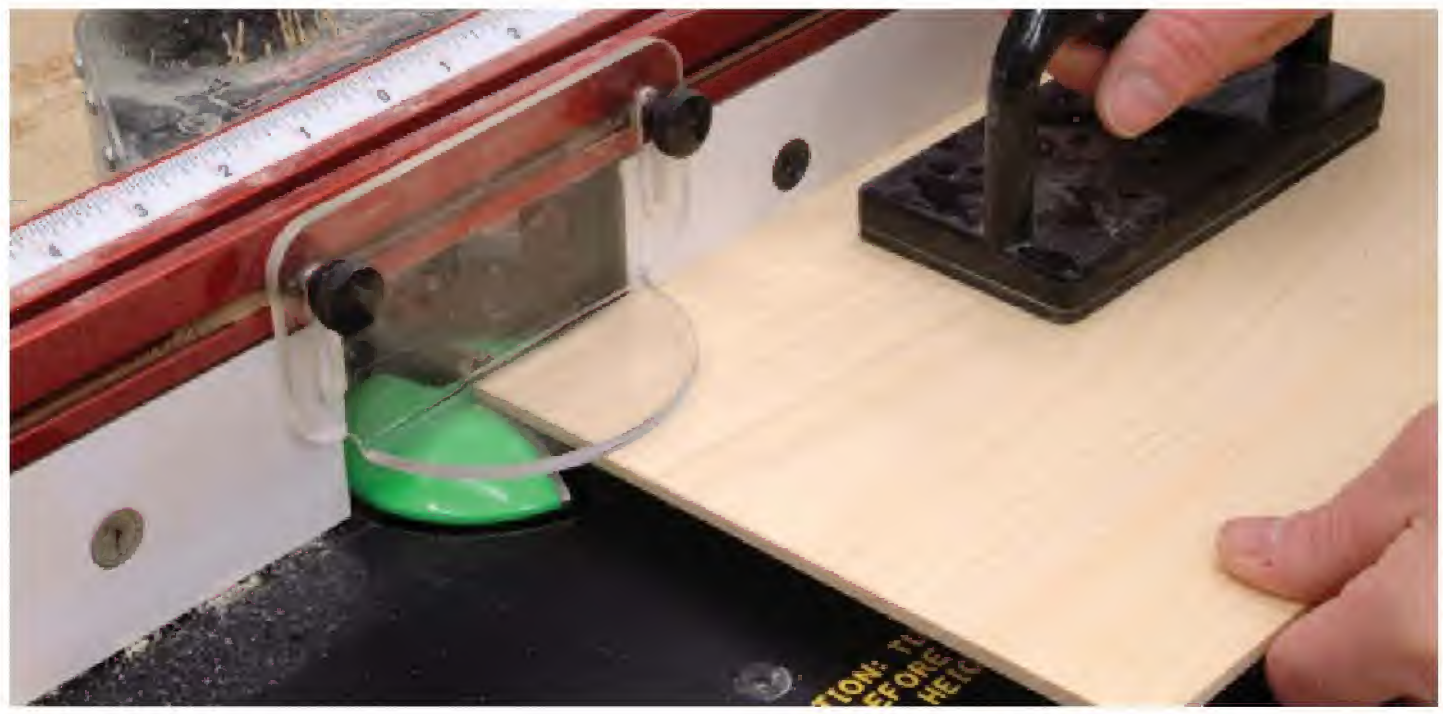
Raised Panel Doors

I've sandwiched this section between the section on flat panel doors and the next on cope-and-stick doors because raised panels can be used with all these doors. There are a number of techniques that can be used to "raise" a solid wood panel, but I will be focusing on the method using raised panel cutters, either in a sturdy router table, or in a shaper. Use the method that best suits the equipment you have in your shop.

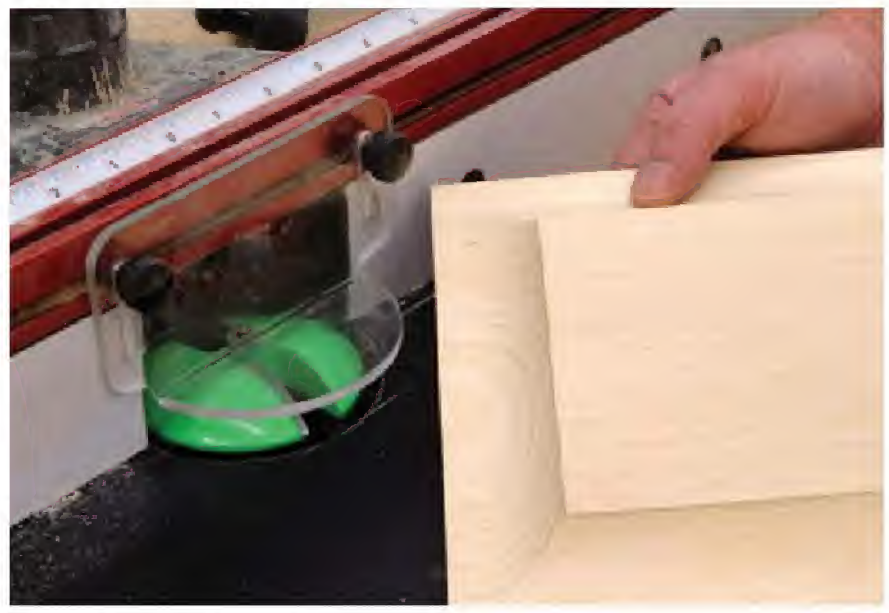
Plain Profile Panel-Raising Cutters

There are many plain panel-raising router bits, but the most common is a simple cove style. These bits have long, medium and short radius cuts, so you'll have to decide which profile best suits your needs.

This group of plain panel-raising bits also includes tapered cutters, which are available in a few different profiles. These bits can be used to make door center panels that can be used with many furniture styles, so it's probably the best one to purchase for general use.



1 Install the panel-raising bit in your router, making certain that it's properly seated and tightly locked in the chuck. Your table should be equipped with a router that's rated at 2 horsepower or more. Many woodworkers maintain that only variable-speed routers should be used because these bits seem to cut better when the router is set at one-half or three-quarter speed. There's a lot of truth in that belief, but I have successfully used fixed-speed routers to raise my panels. Experiment with router speed and panel feed rates to achieve clean cuts. However, even the correct speed and feed rates may not guarantee success; some types of wood, such as oak or maple, tend to splinter or tear out in chunks, so a lot of testing may be necessary.

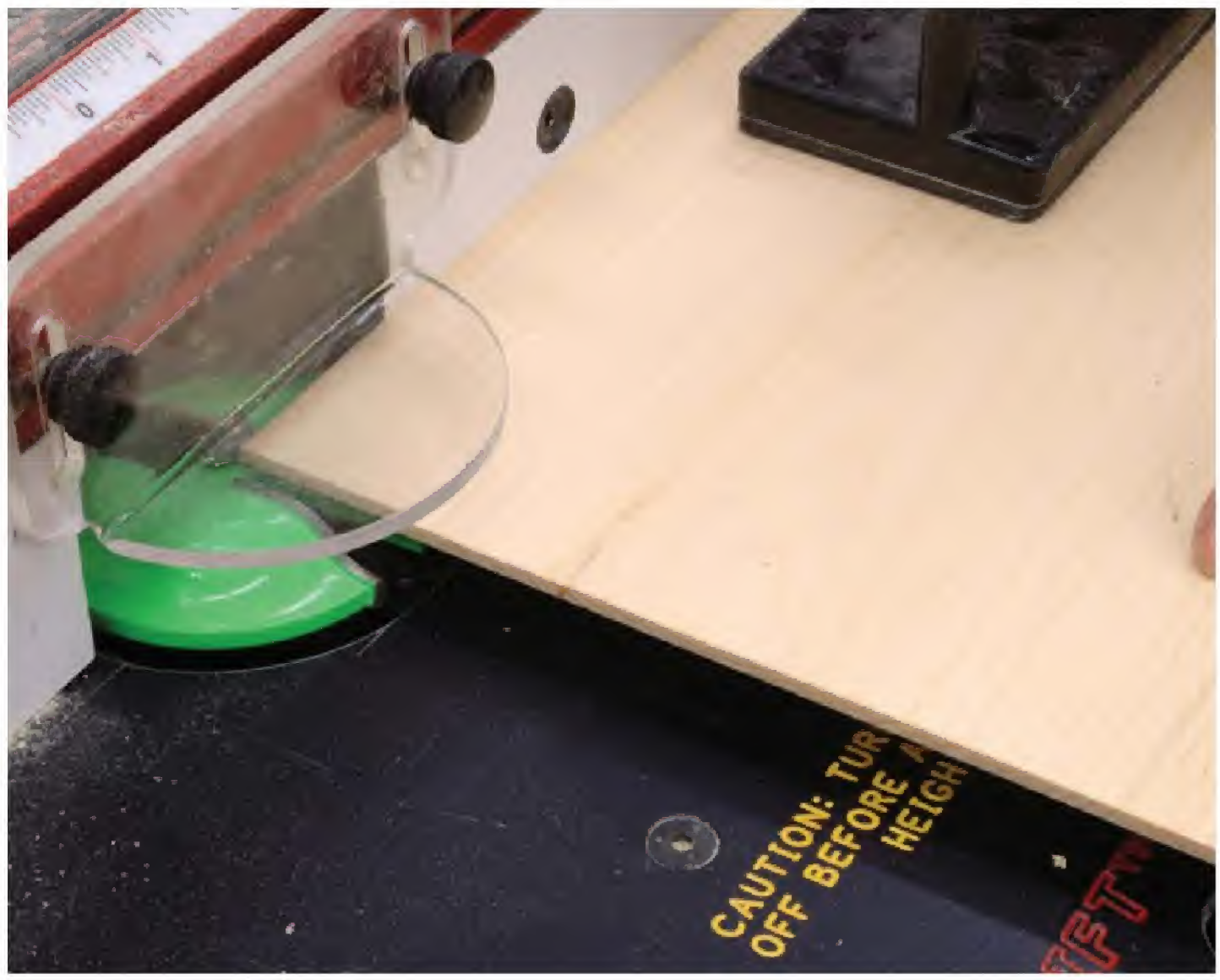


2 It's often better to make a number of small passes rather than one large cut with these cove panel-raising bits. Mill the end grain first, as that's where most of the tear-out occurs; then follow up with cuts along the grain. Continue making the cutting passes until the panel edges are 1/16" thick, or the proper thickness for stile and rail frame grooves.

Figured-Profile Panel-Raising Cutters

Figured panel-raising bits cut a pattern into glued-up panels. I'm using a common ogee-style bit.

Figured bits are often chosen to match cope-and-stick bit sets, which are used to cut tenons, grooves and patterns on the edges of door-stile members and the ends of door rails. You'll find pattern styles called Roman Ogee, Classic Bead, Classic Frame and so on for both stile-and-rail bit sets as well as the panel-raising bit.



1 The milling steps and procedures for the figured bits are the same as those for the simple plain bits. Make a number of small passes and test the cuts on scrap material before making the final cuts on the panels.

2 The panel should be guided by a bearing on the bit using a medium feed rate to achieve smooth cuts. A certain amount of finish sanding will always be required, but you can minimize it by testing for the best feed rate and router speed.

Bits with Back Cutter

These special bits are available in many of the standard profiles but are also equipped with a rear-cutting blade. The back cutter forms a rabbet cut on the rear face of the panel as the face is profiled. This rear cut positions the door so the front face of the frame and panel are on the same level.

1 Both front and rear faces of the raised panel are milled during a cutting pass. The double-profile cut means that a panel must be raised with only one pass per edge. There's a lot of material being removed on each pass, so be sure your router bit is sharp; also test the feed rate as well as the router speed with scrap material before you begin.

2 Typically, a guide bearing controls the cut depth, but I always set up my router-table fence slightly behind the bearing's front face as a safety device. The bearing is the primary control, but the fence prevents the panel from being kicked back in case of a jam. With all these cutters, dust is a major concern, so a good vacuum system is necessary.

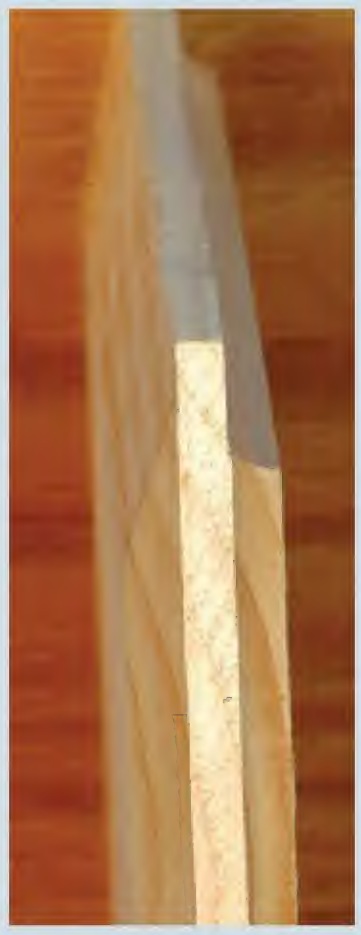
Raised Panel vs. Door Frame Position

This photo shows the edge profile on a panel that was milled with a raised-panel bit equipped with a back-cutting blade. It has a specific purpose that is best explained by studying a raised panel's relationship to the front surface of a door frame.

Door frames, made with two stiles and rails, have a groove in the center to hold a flat or raised panel. The stile and rail grooves can be cut on a table saw or by using a cope-and-stick bit set (see the next page).

These stile and rail grooves are normally centered on the edges, which means that a raised panel of the same original thickness (¾"- thick door-frame material and ¾"-thick raised panels) as the frame will be ¼" higher than the front face of the stiles and rails. The panel is said to be "proud of the frame" because it's held in the groove, which is ¼" in from the frame's back edge.

If you don't mind having a raised center panel proud of the frame, then there isn't a problem. If you want the center panel's front face to be on the same level as the door frame's face, you have two options.



First, you can use ⅞"-thick material for the stiles and rails and ⅝"-thick material for the center panel. The ¼" difference, because the panel is in the grooves that are ¼" above the frame's back face, is accounted for by the thinner panel material.

The other option is to use the same thickness material for the door frame and raised center panel, but you must use a panel-raising bit equipped with a back cutting blade. The center panel's back face will have a ¼" rabbet, which will lower and level its position with respect to the frame's front face. Simply put, we would remove ¼" from the back of the panel edges so the panel would be recessed ¼" from the front surface of the door frame.

Cope-and-Stick Doors

Cope-and-stick doors are much like the tenon-and-groove doors described on page 123. The "tenon" is made with a cope bit and the "groove" on the rail and stile edges are made with a matching stick bit. They are a little more detailed than the simple tenon-into-a-groove design, but only because there are a few added cutting profiles on the bit sets.

These doors can be fitted with a ¼"-thick flat panel as shown earlier, or with one of the raised panels. The panels are held in the "stick" or groove cut by a router bit in a router table. I don't suggest trying to use these bits freehand in a router because they are quite large and remove a considerable amount of material. I recommend using a good router, rated at two or more horsepower, and a solid router table. And even then, be sure to follow the safety recommendations explained this chapter.

COPE-AND-STICK BIT SETS

There are normally two bits in a rail-and-stile cutter set. The inside edges of the rails and stiles are cut with a stick bit and the rail ends are formed to fit the stick cuts with a cope bit. There are a number of different patterns available, much like the panel-raising bits, including plain, ogee, coved and so on.

I prefer a bit set rather than the single rail-and-stile combination bit that has removable cutters for repositioning when each profile is cut. I would also suggest that you use ½"-diameter shank bits in a router capable of taking a ½" shaft, because these bits will come under a great deal of stress.

CALCULATING DOOR SIZES

Take a look at the cutting profile in this illustration. You'll see the tenon-into-a-groove arrangement created by the cutting bits. Each bit set cuts a little differently, so you'll have to calculate how much extra length is required on the rails to produce the final door size required.

Door height is equal to stile length so, if I require an 18"-high door, my stiles will be 18" long. The rail width is another matter because the cope cutter is removing material to form the tenon. The bit set I'm using requires an added ⅞" to the rail length to get the desired door width.

For example, the door I need is 12" wide x 18" high. My stile and rail width is 2¼" so that width is doubled (for two stiles); subtracting that figure from the required final door width of 12" gives me a rail length of 7½". However, for my bit set, I know that an additional ⅞" must be added to the rail length to account for the material removed in cutting. Your bit set will likely be different, so test your measurements on scrap material before you begin making doors to get the waste factor number.

Test the bit set and make a sample pattern for the stile-and-rail cutter. Keep those patterns handy so the bits can be aligned for cutting. It will save a lot of set-up time.

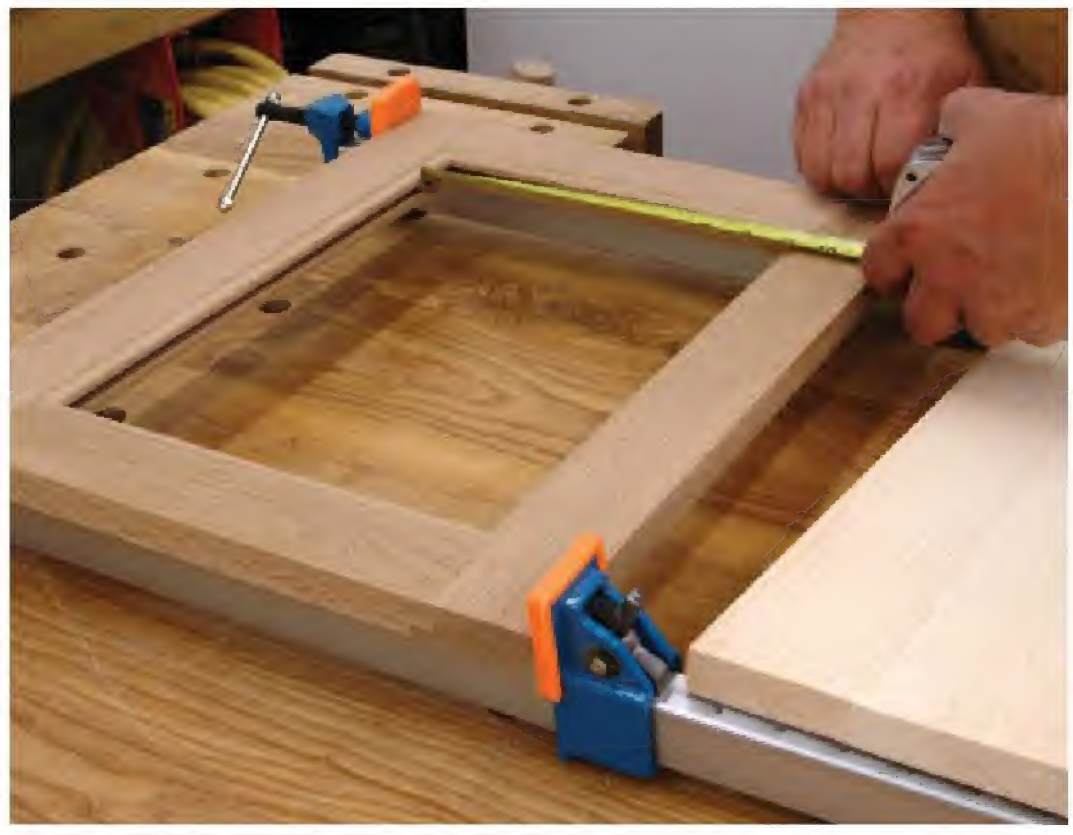
Square Cope-and-Stick Doors

Square cope-and-stick doors are the simplest form of this door style. They are formed with a bit set that cuts tenons and grooves. The process is similar to the tenon-and-groove doors discussed earlier but the patterns are more detailed because of the bit profiles that are used.

Set up your bit set with samples, determine the "adding" factor for rail lengths, and cut the parts to size.

1 Cut the stile and rail parts to size. Cope the ends of each rail with a backer board behind the wood to minimize tear-out. Notice that I'm making the cope cuts first. Some woodworkers prefer this method while others cut the stick profile first. I don't feel one way is superior to the other; I often cut my stick profiles before the rail-end cope cuts. Experiment with both methods to find the procedure that works best for you.

2 Once the rails have been coped, cut the stick profile on the inside edge of both rails and stiles. Before making the final cut, set up the stick bit and use scrap lumber of the same thickness as the rails to match the previously cut coped rails to the new stick setup.



3 Dry fit the door frame and measure the inside dimensions. My groove, or stick cut, depth for the bit set I'm using is 7/16". I want to leave a little room for panel and frame expansion and contraction, so I'll add 3/4" (7/16" plus 7/16" minus 1/8") to the inside height and width of the frame.

4 Cut the center panel to size. At this point you have two options; you can install a ¼"-thick veneer plywood center panel as shown, or a raised solid-wood panel like the ones described earlier.

5 Raised center panels begin as solid-wood glue-ups. The boards can be prepared on a table saw or by using a jointer and planer.

6 Raise the panel using a panel-raising router bit.

7 To reduce door panel "rattle" (because it will be loose in the frame) install small strips of soft foam in the groove. I use strips cut from a roll of soft weatherstripping material that I purchase at my local hardware store. These large rolls of foam are used to insulate doors and are commonly available as well as inexpensive. One roll of weatherstripping will be enough to do dozens of doors. You can also buy any of the commercial products made for this application from your local woodworking store.

8 Assemble the door by applying glue to the cope cuts only. Clamp the door frame and measure the diagonals to be sure they are equal, which means that the door is square. Do not glue the panel in place so it and the frame members can move as humidity levels change.

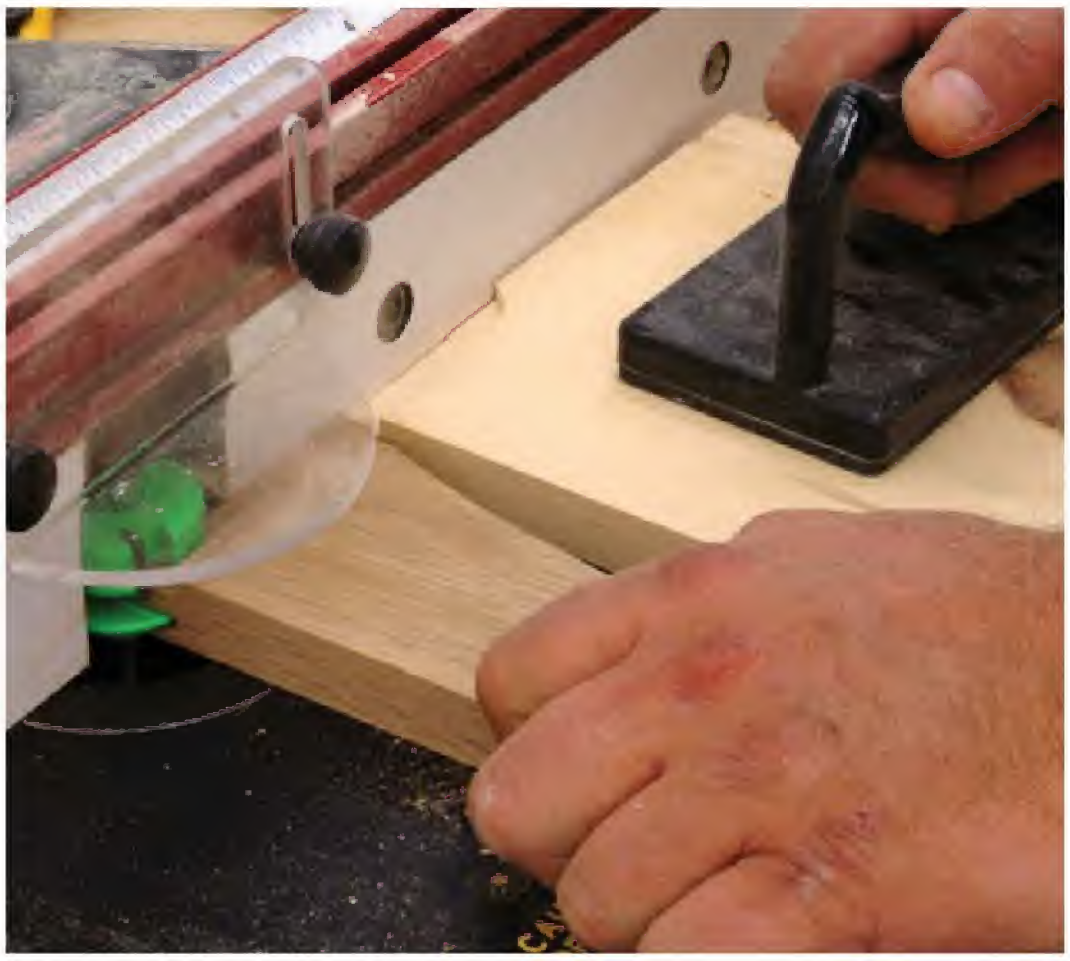
Arch Cope-and-Stick Doors

The arched cope-and-stick door is a variation of the square door. The upper rail, and sometimes both rails, has an arc pattern. The upper rail is wider because material will be removed when cutting the arc.

Maintaining fixed dimensions on all arched doors, particularly those for a project such as kitchen cabinets, makes all the doors appear similar no matter what their width. Refer to page 131 for more details on maintaining visual consistency in arched rail doors.

1 Cut all the parts to size. I usually cut straight rails and stiles 2¼" wide and arched rails at 3¼" wide. Draw the arc on the curved rails.

2 Use a band saw or jig saw to cut the arc. Sand the curve smooth.



3 Cope the rail ends. Remember to keep the rails oriented the same way when cutting — don't flip them. In other words, keep the same face up when you turn the rail to cut the opposite end. Use a backer board to minimize tear-out.

4 Change to the stick bit, align and test the bit for a correct cutting pattern, then cut the straight stiles and rail.

5 The curved upper rail edge requires a stick cut. Use a push pad and carefully enter the cutter. Most router bits spin counterclockwise in a table, so the wood can be pushed backwards and onto the leading face of the bit. Hold the board securely and enter the bit's cutting path carefully. Notice that my router fence is set slightly behind the bit to act as a backstop should the work piece be thrown back. Use care and all safety devices when cutting the curved rails.

6 The center panel can be a ¼" thick piece of plywood veneer or a solid-wood raised panel. The simplest method to determine panel size is to lay the door frame on the panel and trace inside the frame. Notice that my upper curved rail is ⅜" higher in the door frame than normal. This will allow me to draw the correct cut line for the curve, which will properly sit in the 7/16"-deep groove made by the stick router bit.

7 Prepare the panel of your choice. Raising curved panels with a router bit is fairly easy as long as you push the panel smoothly through the bit and keep it tight to the bearing.

8 Apply glue to the rail ends and assemble the door. Clamp the door frame and make sure that it's square.

Cathedral Cope-and-Stick Doors

Cathedral-style cope-and-stick doors are a variation of the arched door. The arc is shorter, leaving equally dimensioned straight lengths of the rail at either end. The combination of straight and arched cuts in the rail distinguishes the cathedral style. These doors are referred to by other names but to save confusion I'll refer to them as cathedral doors.

Once again, a router stick bit will be tracked in a curve, so exercise caution and follow the previous suggestions about safe practices. If you'd prefer not to get too close to the bit with a push pad, use the curved router jig. Always wear safety glasses and hearing protection, and keep the router-table fence as close as possible to the bit as a safety precaution.

1 Cut all the parts to size. I usually cut straight rails and stiles 2¼" wide and arched rails at 3¼" wide. Draw the arc on the rails, leaving 1⅛" of straight rail on either side of the arc. The arc rise at its center point is 1"; the radius formula can be used to determine the compass setting.

2 Use a band saw or jig saw to cut the arc. Sand the curve smooth.

3 Cope the rail ends. Remember to keep the rails oriented the same way when cutting — don't flip them. In other words, keep the same face up when you turn the rail to cut the opposite end. Use a backer board to minimize tear-out.

4 Change to the stick bit, align and test the bit for a correct cutting pattern, then cut the straight stiles and rail. The curved upper rail edge requires a stick cut as well. Use a push pad and carefully enter the cutter. Most router bits spin counterclockwise in a table, so the wood can be pushed backwards and onto the leading face of the bit. Hold the board securely and enter the bit's cutting path carefully. Once again, notice that my router fence is set slightly behind the bit to act as a backstop should the work piece be thrown back. Use care and all safety devices when cutting the curved rails.

5 The center panel can be a ¼"-thick piece of plywood veneer or a solid-wood raised panel. The simplest method to determine panel size is to lay the door frame on the panel and trace inside the frame. As with the arched door, notice that my upper curved rail is ⅜" higher in the door frame than normal. This will allow me to draw the correct cut line for the curve, which will properly sit in the 7/16"-deep groove made by the stick router bit.

6 Prepare the panel of your choice. Push the panel smoothly through the bit and keep it tight to the bearing. Apply glue to the rail end and assemble the door. Clamp the door frame and make sure that it's square.

Cabinet Drawers

Drawers are required for many woodworking projects. You'll find them in desks, kitchen cabinets, storage cabinets, workshops and many more applications. We need drawers to store and organize all sorts of things in every room of the house, office and workshop.

Some woodworkers believe that a drawer lacks quality unless it's built with dovetail joinery. I don't hold that opinion. There are dozens of ways to build high-quality drawers, and all of them have a purpose and place in modern cabinetry.

I'll start by describing drawers made with melamine particleboard (PB) and then move on to other materials such as Baltic birch plywood and solid wood. I'll explain some of the joinery options as well as the hardware that can be used for your drawers.

Calculating Drawer Sizes

FACE FRAME CABINETS

In general, the 1" rule applies to most drawer-building projects when using modern hardware. Bottom-mounted and side-mounted slides made by manufacturers such as Blum and Accuride require a ½" space between the outside of the drawer box and the cabinet side for proper installation and operation. Simply stated, the drawer box is 1" narrower than the cabinet's interior width.

The drawer opening is measured from inside edge to inside edge of the face frame. Subtract 1" from that dimension, which will give you the drawer box's outside width. To simplify matters, I also subtract 1" from the drawer opening height to determine my drawer box height.

This "rule" is very general, so I suggest you read the manufacturer's instructions packed with your hardware. One important issue to keep in mind if you plan to use the new hardware: most drawer-glide systems are designed to operate based on frameless-cabinet building styles. The cabinet's side is the cabinet's face and therefore the opening equals the sides' inside face-to-face dimension. But, that doesn't mean the hardware cannot be used with face frame style cabinets.

If the face frame's inside width is smaller than the cabinet's inside width, cleats or spacers must be installed to mount the glides flush with the inside of the face frame. It's a simple matter of attaching small strips of wood to mount the hardware.

FRAMELESS CABINETS

The same 1" rule applies to most drawer-building projects when building frameless cabinet drawers. Most drawer slides require a ½" space between the outside of the drawer box and the cabinet side for proper installation and operation.

The drawer opening is measured from the inside face of one side panel to the inside face of the opposite side panel. Subtract 1" from that dimension to determine the drawer box's outside width. This "rule" is very general, so I suggest you read the manufacturer's instructions packed with your hardware.

Calculating drawer-box heights for frameless cabinets is a little more involved. First, use the height measurement for a standard door in your project. For kitchen cabinets, a full-height base cabinet door is used as a reference. Drawer-face heights, plus the 1/16" gap between them, should equal the height of base cabinet doors in the same project. A three-drawer base should have a combined drawer face and gap height equal the standard door height.

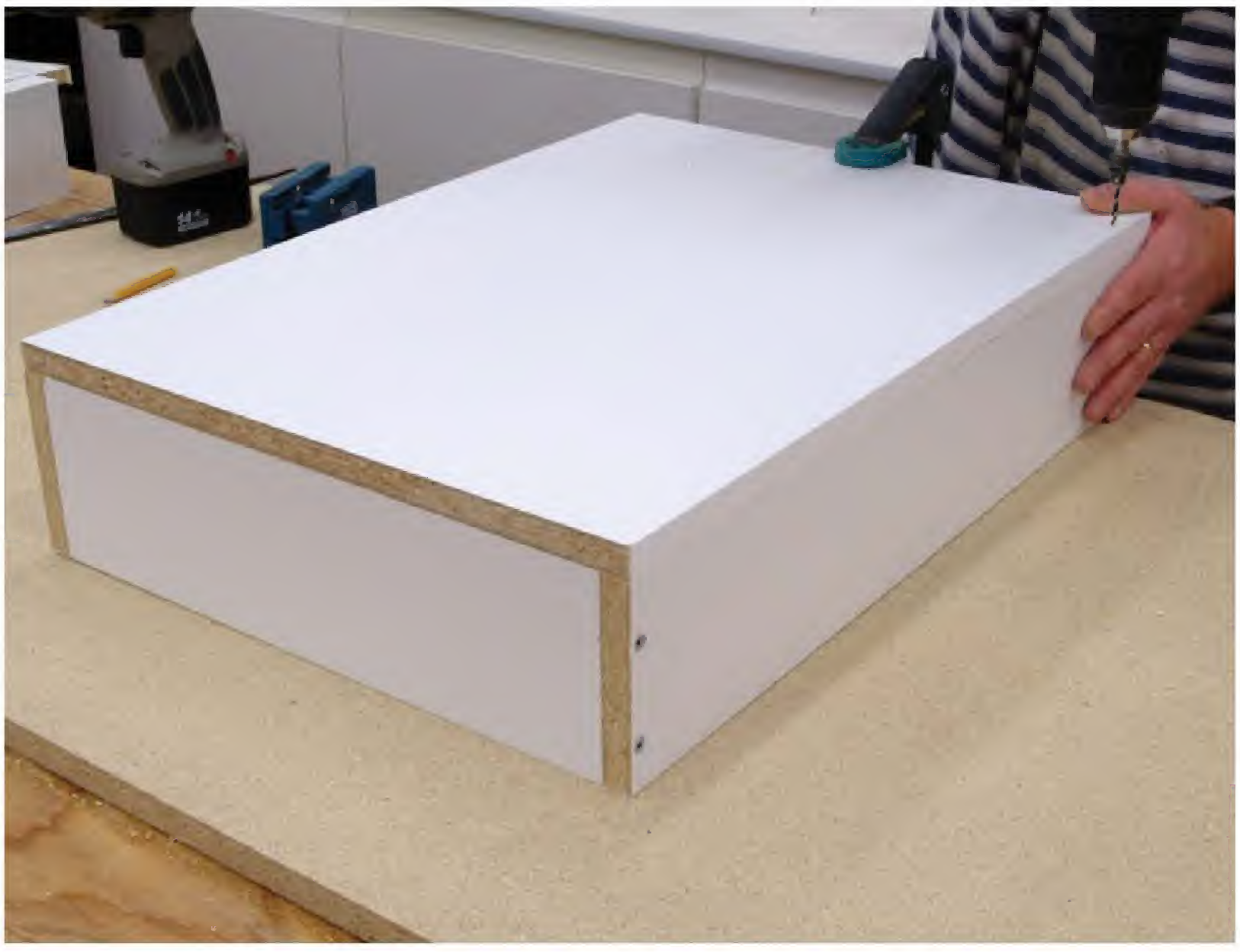
Decide on the height of each drawer face according to your requirements. For example, a three-drawer base could have two 10 15/16"-high bottom drawer faces and one 8"-high top drawer face, as well as two 1/16"-high gaps. The total height of the faces and gaps is 30", which should equal the standard full-height door in your project.

All drawer boxes, with the exception of the top box, are 2" less in height than their drawer faces; the top box is 3" less in height than its drawer face. This cabinet requires two 8 15/16"-high lower drawer boxes and one 5"-high top drawer box. The lower box is installed tightly against the bottom board and the boxes need a 2" vertical space between each other. The top box is set 1" below the lower edge of the top rail.

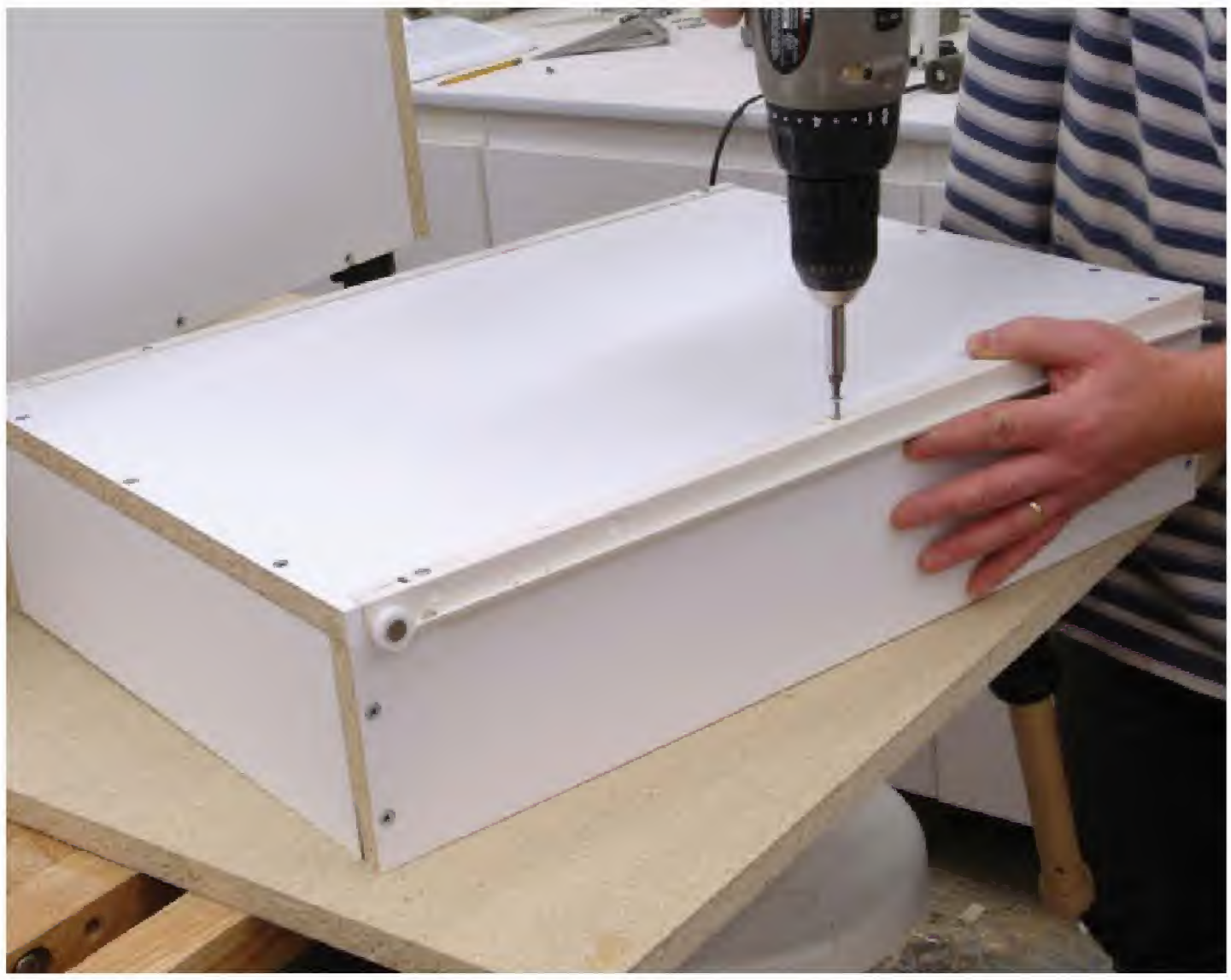
Melamine Particleboard Drawers

One of the most common applications for drawers and pullouts is in the kitchen. Just about every kitchen cabinet project involves drawer-building. You'll find banks of drawers, drawer-over-door cabinets and pullouts. It's not unusual to have ten or twelve drawers in the average kitchen. Often, these drawers are constructed using melamine PB and butt joinery secured with biscuits or 2"-long PB screws. The following steps outline an excellent method to use when building melamine PB drawers.

1 Cut the sides, front, back and bottom boards to size using ⅝"-thick melamine PB. The exposed top edges as well as the side edges of the bottom board can be covered with heat-activated iron-on edge tape. Join the sides to the front and back boards using biscuits, glue, and clamps or 2"-long PB screws. Always drill a pilot hole and then counterbore the hole slightly before driving any screws into the joint.



2 Attach the full-thickness bottom board with 2" PB screws. If the bottom board was cut square, the drawer box will be square.



3 The drawer box can be fitted with bottom-mount drawer glides. They are aligned flush with the front edge of the box and secured with ⅝"-long screws. Standard drawer-glide sets will allow the drawers to slide out of the cabinet three-quarters of their length. They are easy to install, reliable, inexpensive, and operate smoothly on nylon-bearing wheels.

4 The cabinet runners are part of the drawer-glide set and are secured to the cabinet's sides with ⅝" screws. Set them back ⅛" from the cabinet's front edge and at 90° to that edge. Use a carpenter's square, resting on the front edge of the cabinet, to draw a reference line to help align the runners.

5 Test the drawer's operation. It should slide smoothly in and out of the cabinet and rest firmly on the runners. Push down on each front corner of the drawer to test its stability. If either front corner moves down as you press, the runners must be realigned. A "bouncing" drawer corner means that the cabinet runner on that side is too high at the back end and should be lowered slightly. Test the front corners and adjust the cabinet runners until both sit firmly on the glides.

Birch Plywood Drawers

Half-inch-thick Baltic birch plywood is the favored material of many cabinetmakers for building drawer boxes. The drawer parts can be joined in a number of ways, but I'll explain the simplest method using rabbet butt joints and brad nails.

Baltic birch is also a good material to use when building pull-out drawers behind doors. It's light, and the void-free edges can be sanded and finished.

1 Each side board has a ¼"-deep by ½"-wide rabbet on both ends to accept the front and back boards. The rabbets can be cut with a dado blade on your table saw or on a router table. The rabbet depth equals one-half the board's thickness.

2 The drawers are assembled using glue and brad nails. Apply glue to the rabbet cuts and attach the side boards to the front and back boards. The bottom is also attached with glue and brads.

3 Install the drawer-glide hardware following the manufacturer's instructions. Most slide hardware, as mentioned earlier, needs ½" clearance on each side of the drawer box. For this application I used side-mount full-extension (FX) glides, but a standard three-quarter extension glide will work just as well.

Finger-Jointed Solid-Wood Drawer Boxes

Here's a variation of a solid-wood drawer box that can be built with finger joints. The bottom ¼" panel is nailed and glued on the bottom edge of the side, front and back boards. Another style of solid-wood box, with the bottom in a groove, is shown on page 148.

This drawer box, or tray, tracks on wood runners in grooves cut along the side boards. The drawers can also be installed using conventional drawer glides, but there must be a ½" space on each side as explained earlier in this chapter.

1 **RIGHT** The trays are 1/16" narrower than the cabinet's inside width. The sides, back and front boards are ¾" hardwood stock. I used finger joints for the corner joinery here, but many other joints can be used. If you decide to use a screw-and-butt joint, don't place the screws in the middle of the side boards because grooves will be cut in the center.

Cut the parts to size, then set up your ½" finger-cutting jig. Each finger and slot for these joints is ½" wide. To properly interlock, the sides are indexed differently from the front and back boards. Remember to orient the boards properly when cutting each end. To guarantee correct positioning, place a mark on the bottom edges of the tray boards. Now, start all the cuts on both ends of each board with the mark facing the fixed pin.

Assemble the four trays with glue applied to all fingers and slots. Clamp the trays and measure the diagonals to ensure that they are square. If the measurements are different, a slight twist or tap on the long side should equalize the measurements.

2 **LEFT** To achieve as much drawer depth as possible, glue and nail ¼"-thick veneer plywood to the tray frame bottoms. A ¾"-wide groove is needed on both sides of each tray. They will fit over solid-wood tray runners and should be centered on each side.

The best tool to cut these grooves is a stacked dado blade on a table saw. Begin with a ¼"-deep groove on each side and test-fit the tray. If necessary, cut the grooves a little deeper to achieve the correct fit. The tray should be snug on the slides, without binding; they can be fine-tuned with sandpaper and waxed until they slide smoothly.

Conventional Wood Drawers

The drawer-box construction standard, before the introduction of modern materials and hardware, was a box with solid-wood sides, front and back boards. Rabbet joints were used on the corners and a ¼"-wide groove was cut in the front and side boards. The back board was reduced in height to accept a ¼"-thick plywood bottom that would overlay the back edge.

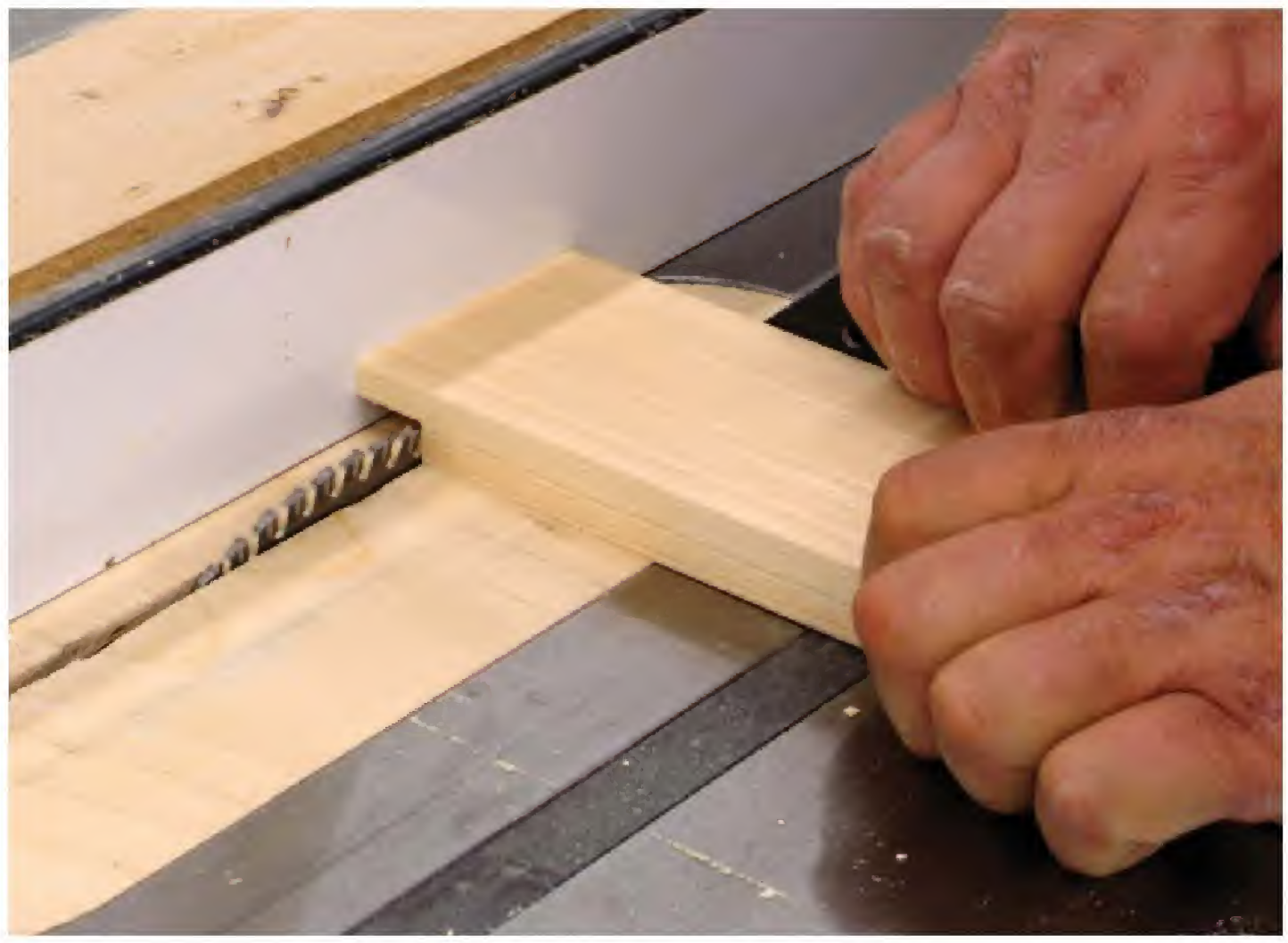
The bottom board was inset because the side-board's bottom edges tracked on wood runners. With the inset bottom, only the side edges would be in contact with the runners to reduce friction. The wood parts that contacted each other would have a coat of wax applied to reduce drag.

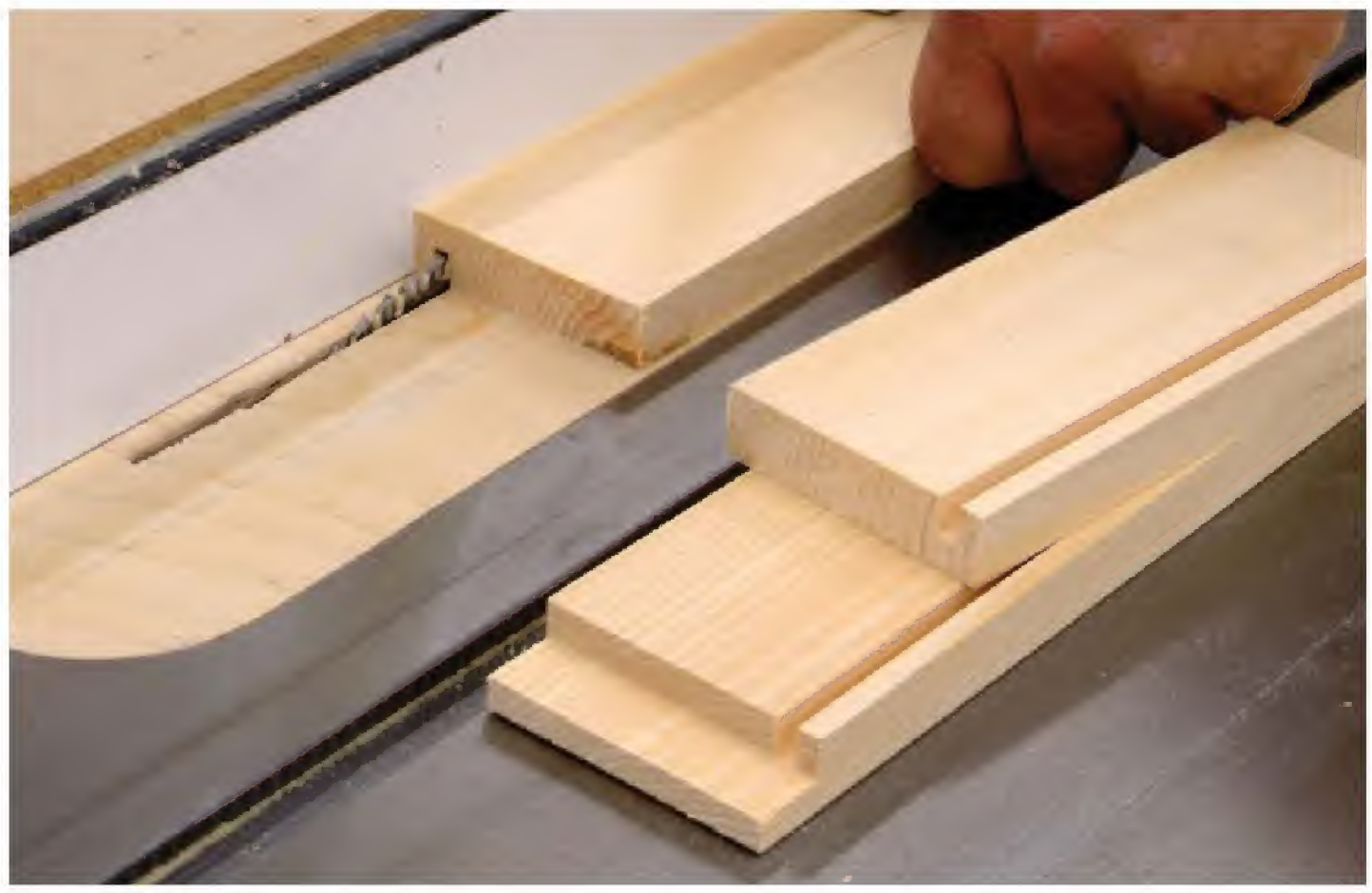
Many cabinetmakers still build that style of drawer today. However, an inset bottom isn't necessary any longer because drawer boxes track on modern ball-bearing and nylon drawer-glide sets. If you plan to build cabinets to match older-styled cabinets, you may want to use the inset-bottom and wood-runner combination.

---

1 This sample drawer box is 9" deep × 28½" wide. The depth is 3" at the front face. Use a dado or a standard blade on the table saw to form a ⅜"-deep × ¾"-wide rabbet cut on each end of the drawer-front's back face. If the front will be covered with a drawer face, cut the rabbets in the side boards so the ends of the joints will be hidden. I cut the front and back boards for this application because I won't be adding a drawer face on this box.

2 The two side boards and the front all need a ¼"-wide × ⅜"-deep groove on the inside face to receive the bottom board. This groove begins ¼" above the bottom edge of each board.



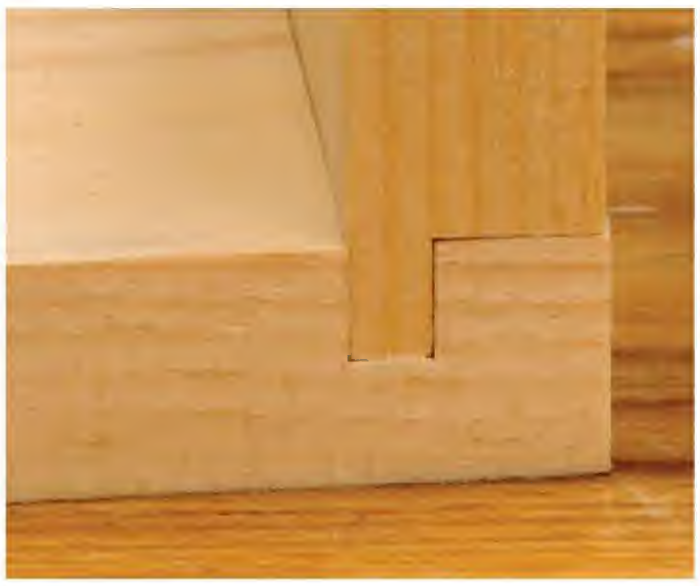


3 Apply glue to the front-board rabbets and attach the sides with 1"-long brass screws or finishing nails. The grooves on the sides and front board must align to receive the bottom board.

4 The drawer's back is 2½" high so the ¼"-thick bottom board can be attached to its bottom edge. Attach the back board to the side board ends with glue and 1½"-long screws. Slide the bottom panel into the grooves and secure it in place with a few brad nails driven into the back board. Or, you can use a rabbet joint on the back corners if desired.

5 Drawer glides are simple, small strips of wood that are glued and screwed to the cabinet's sides. Locate the glides so there is 1/16" clearance above the drawer box. If you are building a bank of multiple drawer boxes, each with an attached drawer face, leave 1" vertical space between boxes. The faces are applied so there's a 1/16" gap between them for frameless cabinets, or wider spaces for face-frame-cabinet drawer faces. Face-frame cabinets can be spaced more widely because there's a rail to cover the gap.

Dado-and Rabbet Drawer Joinery

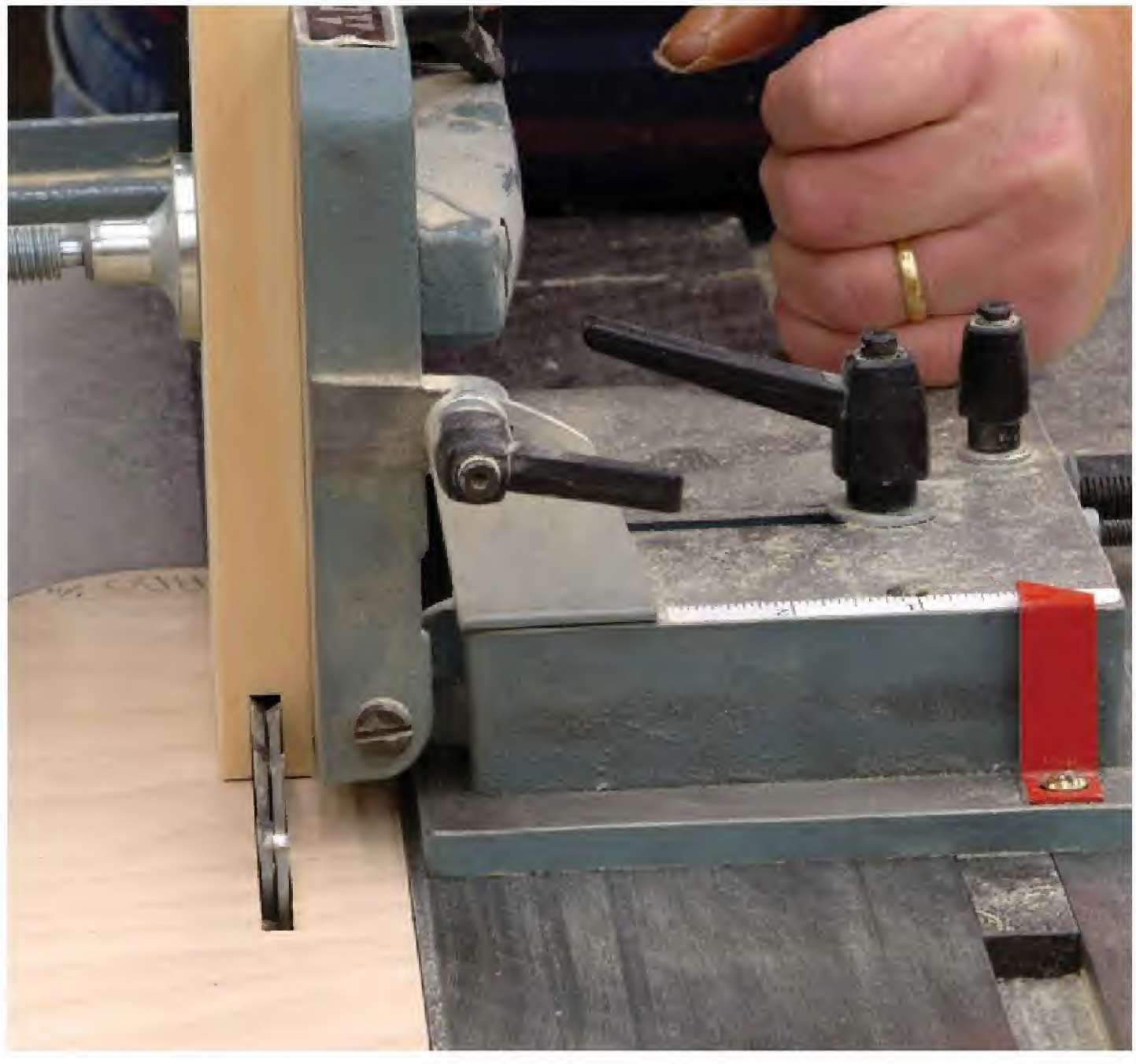


1 The dado is ⅜" deep and ¼" wide, with its back edge set ¾" from the board's edge. This joint is easily cut with a stacked dado blade on a table saw.

This combination joint uses a rabbet and dado to form a strong bond between the drawer's sides, front and back. The goal is to maximize surface area, which creates a stronger bond between the two parts when glue is applied. The ¾" surface area of a butt joint is doubled; when multiplied by the board's length, the board-to-board contact area increases dramatically. Clamp the joint assembly until the glue sets up.

2 The rabbet is ½" deep and ⅜" long. It also is easily formed with a stacked dado blade on a table saw. Both cuts can also be made on a router table with a ¼"-diameter router bit.

Locking Rabbet Drawer Joinery



This locking rabbet joint is an excellent choice for drawer construction. Not only does it dramatically increase the glue surface area, but it also provides mechanical strength. The locking rabbet is made using a table saw and tenoning jig. There's a little setting up to do before you cut the drawer joints, and it would be a real plus to have a stacked dado blade for your saw.

The sample drawer for this joinery project will be 3½" high × 8" wide by 22½" long. I'm using solid pine with a 1½"-thick veneer plywood bottom board.

1 Cut a groove in both ends of the drawer's back and front boards that's ¼" wide and ¾" deep. Center the groove using a tenoning jig and stacked dado blade.

2 Remove ⅜" from one side of the material forming the groove. Complete this step for both front and back boards at each end. Be sure to remove material on the same face of each board.

3 Form a dado on the inside face of each side board that's ⅜" deep and ¼" away from each end. Notice that I'm using a backer board for many of these cuts to prevent tear-out of my drawer boards as I finish the cuts.each board.

4 Cut a groove for the bottom board in the two sides and front board. The groove begins ¼" above the bottom edges of the boards and is ⅜" deep.

5 Trim the bottom edge of the back board by ½", making it 3" high.

6 Assemble the drawer box with glue and clamps. The bottom ¼"-thick plywood panel is 7½" wide × 22⅛" long. It slides into the grooves and overlays the back board's bottom edge. Don't glue this panel in place; it's held with brad nails, as illustrated.

Hand-Cut Dovetails for Drawer Joinery

This traditional joinery method has been in use for decades. Fine furniture, both antique and modern versions, have always been associated with hand-cut dovetail joinery. It's one of the strongest woodworking joints available because it has mechanical strength as well as a large surface area for adhesives.

Hand-cutting dovetails takes practice, but you can easily master this joint in a short time with a little patience. There are many ways to cut dovetails. I'll illustrate one method that doesn't require any special alignment tools. In fact, measurements are not taken and guides are not used to make the joint shown here.

1 Use a marking gauge to inscribe lines on both faces of each board. The gauge should be set at a distance equal to the board's thickness.

2 Cut the pins first. One half pin at both ends of the board is required. The angle is about 10° and the widest part of the half pin is about one-half the board's thickness. The angle cut and pin size aren't that critical because this pin board will become the template to cut the matching tail board. Be sure to cut level and straight down to the marking gauge line on each side of the board.

3 Cut the first tail space along a line opposite to the half-pin cut. The widest part of the tail space will be approximately equal to the board's thickness. Cut straight down to the marking gauge lines.

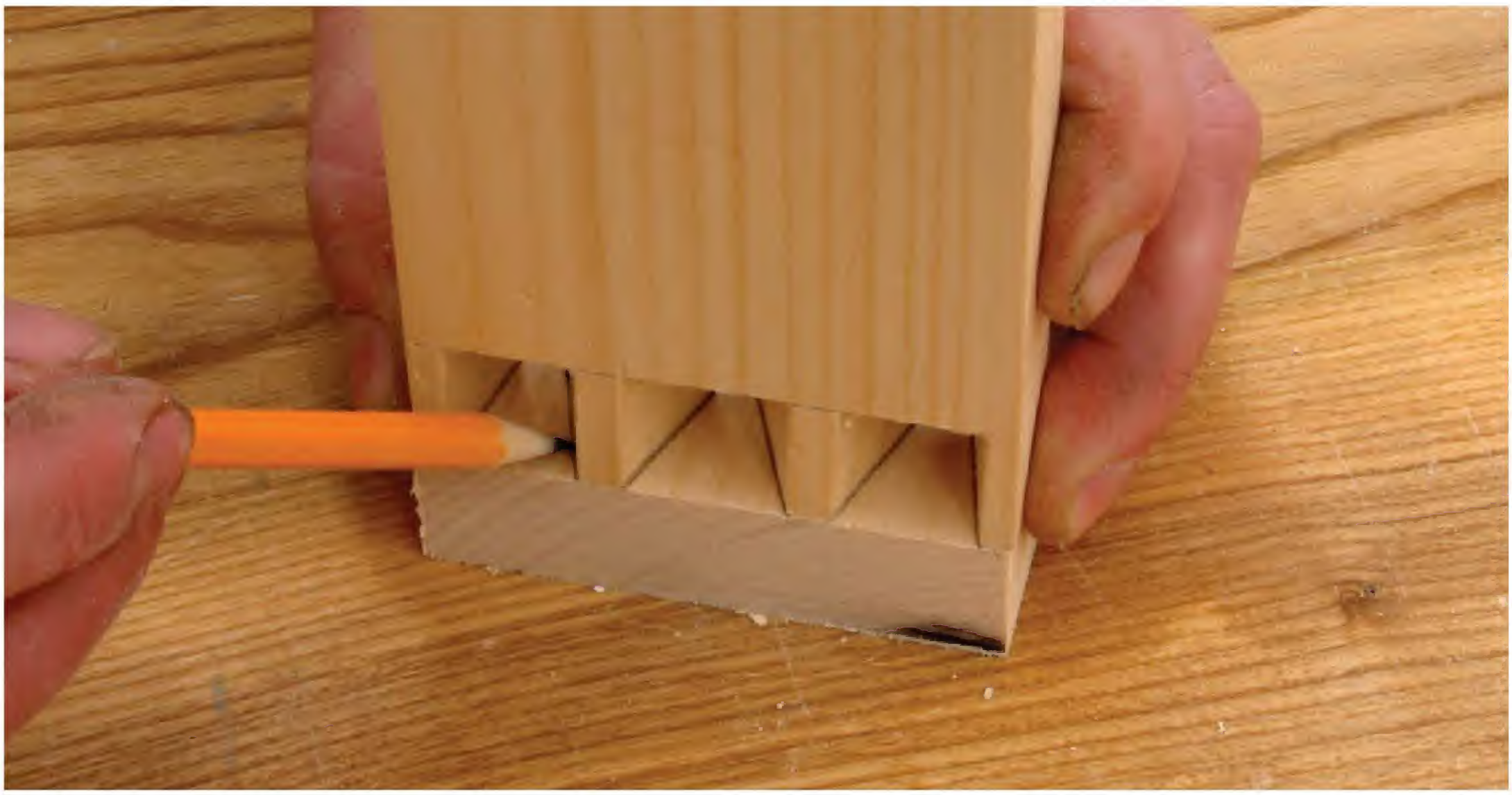
4 Divide the remaining space in half and cut down to the lines at the same angle as the previous cut.

5 Turn the saw to the same angle as the first half-pin cut. Divide the remaining spaces in half and cut down to the lines. These two cuts will form half pins, full pins, and full tails. Repeat the steps for wider boards. The final number of pins and tails will depend on the width of the boards to be joined.

6 Chisel out the tail spaces by first cutting along the lines with a sharp chisel.

7 **LEFT** Chisel halfway through the tail spaces. Turn the board over and chisel the remaining halfway through the board, then carefully remove the waste.

8 **BELOW** Use the pin board as a template to mark the tails. Mark the waste area to be removed with an *X* after tracing the pin outline on the tail board.



9 **LEFT** Cut the tail lines, being careful at this point to follow the lines. Keep the saw running accurately along the lines on the waste side of each cut.

10 Remove the half-pin waste area by cutting straight to the previously cut lines. Repeat the step on each side.

11 Cut along the marking gauge lines with a chisel and begin removing the waste. Material cannot be forced forward because of the taper on the tails, so cut through from each side and remove the waste material by pushing it out one side. Test-fit the joint and fine-tune with a file if necessary. Apply glue, assemble the joint, and clamp until the adhesive sets.

Machine-Made Dovetails

For those woodworkers who like using dovetail joinery but prefer a machine method, there are dozens of options available. The marketplace has plenty of machine offerings at a variety of prices. A router and dovetail bit are used to follow a pattern of slotted guides to form the dovetail pins and tails.

All dovetail-cutting jigs come with detailed instructions and some also provide a video about using the jig. Each machine is slightly different, so a general explanation isn't possible. However, there are a number of excellent jigs that will allow you to make perfect dovetails for all your drawer-joinery requirements.

door & drawer hardware

The hardware used to mount doors and drawers demands that both fit properly and are correctly sized. The methods used to calculate the correct size for both drawers and doors will be discussed in this chapter.

There are differences between frameless and face-frame style cabinets that must be taken into consideration when doors and drawer boxes are installed. Two common door-hinge mounting styles are overlay and inset. The overlay door is attached to the cabinet or carcass box with hinges and partially covers the front edges of the cabinet. The inset door is set into the cabinet opening, flush with the outside face. There are of course variables on the two, including half-overlay and pocket-mounting styles. However, the two generally accepted terms for door-fitting styles are the overlay and inset door.

Drawer boxes that are mounted on mechanical slides also demand that you accurately size each box to its opening. In general, bottom-mount or full-extension side-and-bottom mounted glide sets require a ½" space on each side of the drawer box for correct fitting. However, manufacturers have different specifications, so you should verify the space requirements before building the drawer box.

Many references in this book involve the hidden or concealed hinge. The popularity of the hidden hinge has grown so much that it's now the standard hinge for cabinetry. Traditional butt and overlay hinges are reasonably straightforward to install, so detailed explanations aren't necessary; but installing hidden hinges requires an understanding of their technical specifications and other issues. Those hinges, and modern drawer-glide hardware, will be the focus of this book with respect to mounting drawer boxes and doors.

Face-Frame vs. Frameless Cabinets

You should be aware of the cabinet style before building cabinet doors and drawers. Are they *face-frame* or *frameless* cabinets? The two main styles of cabinets have many variations but can be generally classified by either style. However, being aware of which type you are building will help determine the door and drawer hardware requirements.

A face-frame cabinet has a solid-wood frame attached to the front edges of the cabinet box. A frameless-style cabinet has the carcass panel front edges covered with a tape, which can be paper or wood veneer. In many cases, the edge tape is applied with an iron that activates the adhesive.

The frameless cabinet is the one at the left in the photograph. Notice the similar construction methods for the face-frame cabinet on the right. It's a frameless cabinet with a solid-wood front frame attached.

European Hinges

Door-mounting hardware from Europe has become a very popular alternative. The so-called "Euro hidden hinge" is now widely used as the standard kitchen-cabinet door hardware.

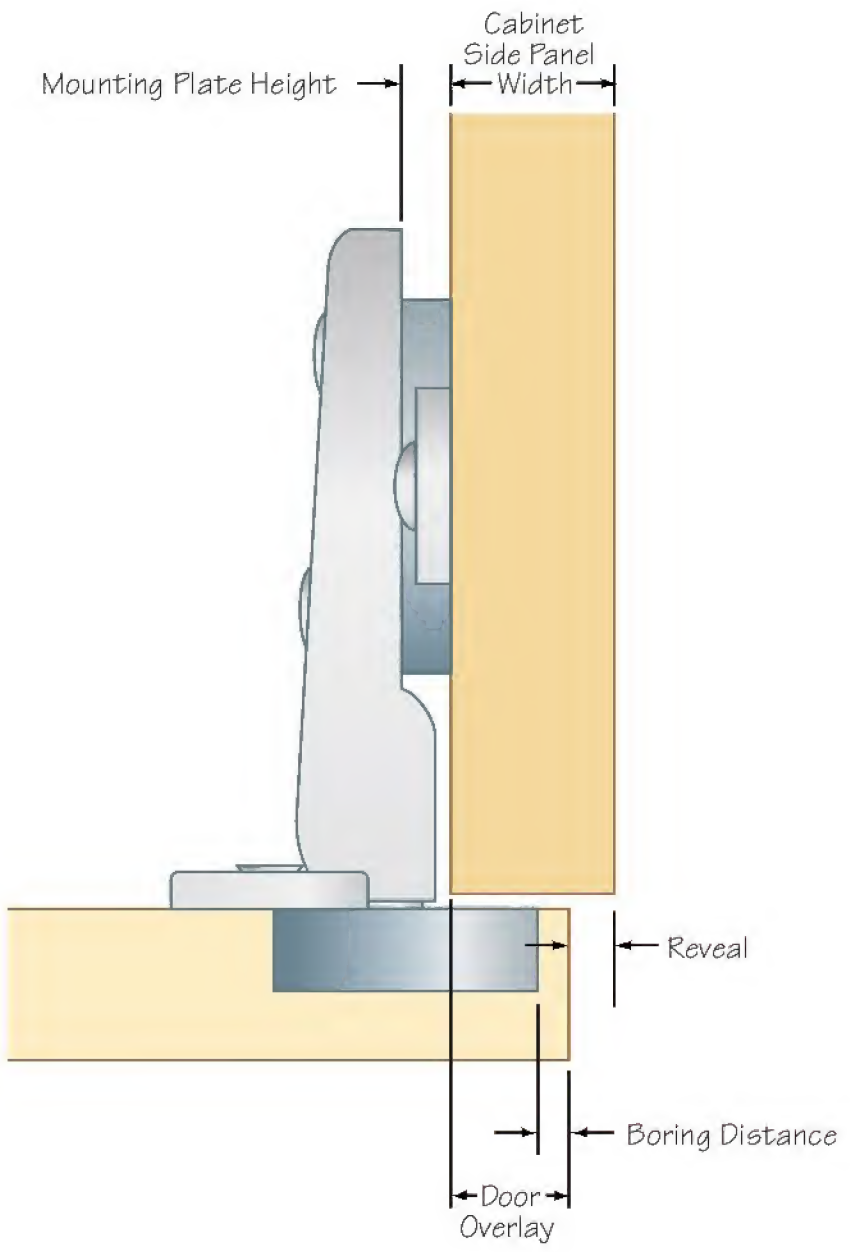
The hidden hinge usually requires a hole drilled in the door. That task may seem a bit challenging to some people, but it's a straightforward process. Working with the hidden hinge does require familiarity with some new terms and concepts. For example, these hinges are classified with terms such as full-overlay, half-overlay and inset. Overlay refers to the amount of the cabinet's side panel covered by the door.

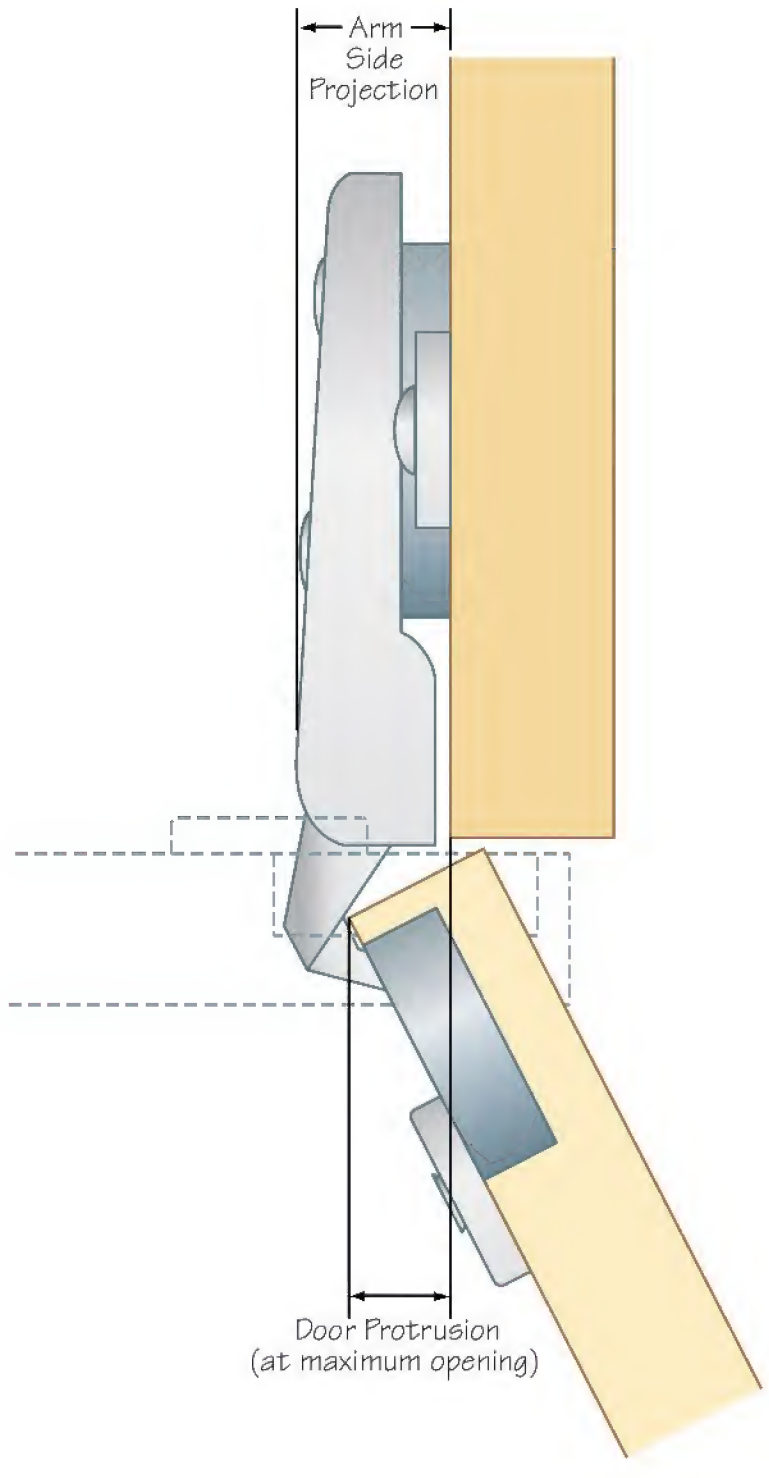
The hinge on top is a 170° wide-opening model and the one below is a standard 100° hinge. The hinge plate beside the top hinge is a standard cabinet side-mounting plate; the plate below it is used to mount hinges on face frames. The face-frame mounting plate is used when the cabinet frame's inside stile edges are not flush with the inside fac of the cabinet-box side panels.

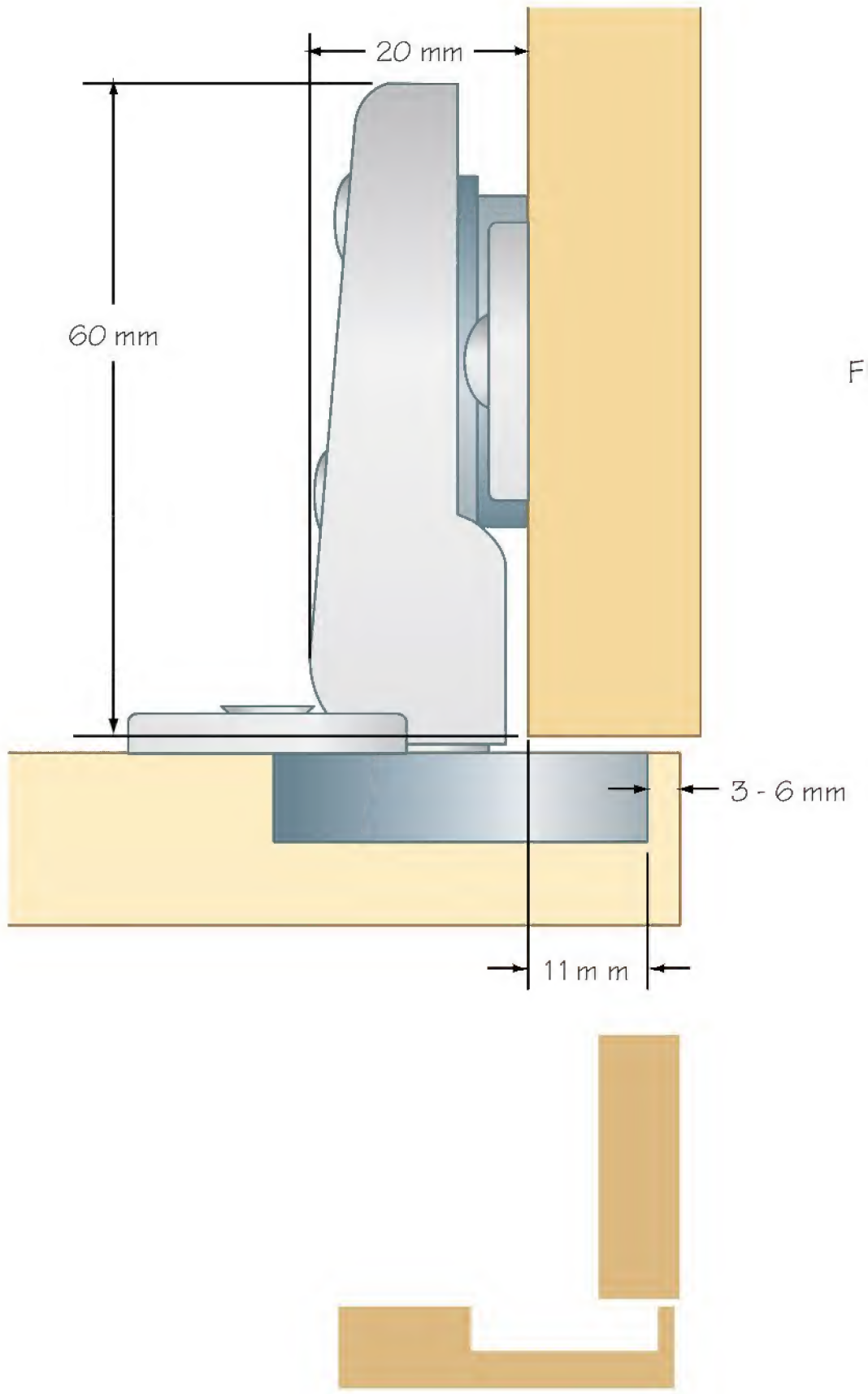
The hidden hinge comes in two parts. The hinge boss, or body, which is mounted on the door in a 35mm-diameter hole. The mounting plate is attached to the cabinet side. The body is attached to the mounting plate with a screw or a clip pin. The clip-on method is popular because you can remove the door from the mounting plate without disturbing any adjustments.

Hinge Opening

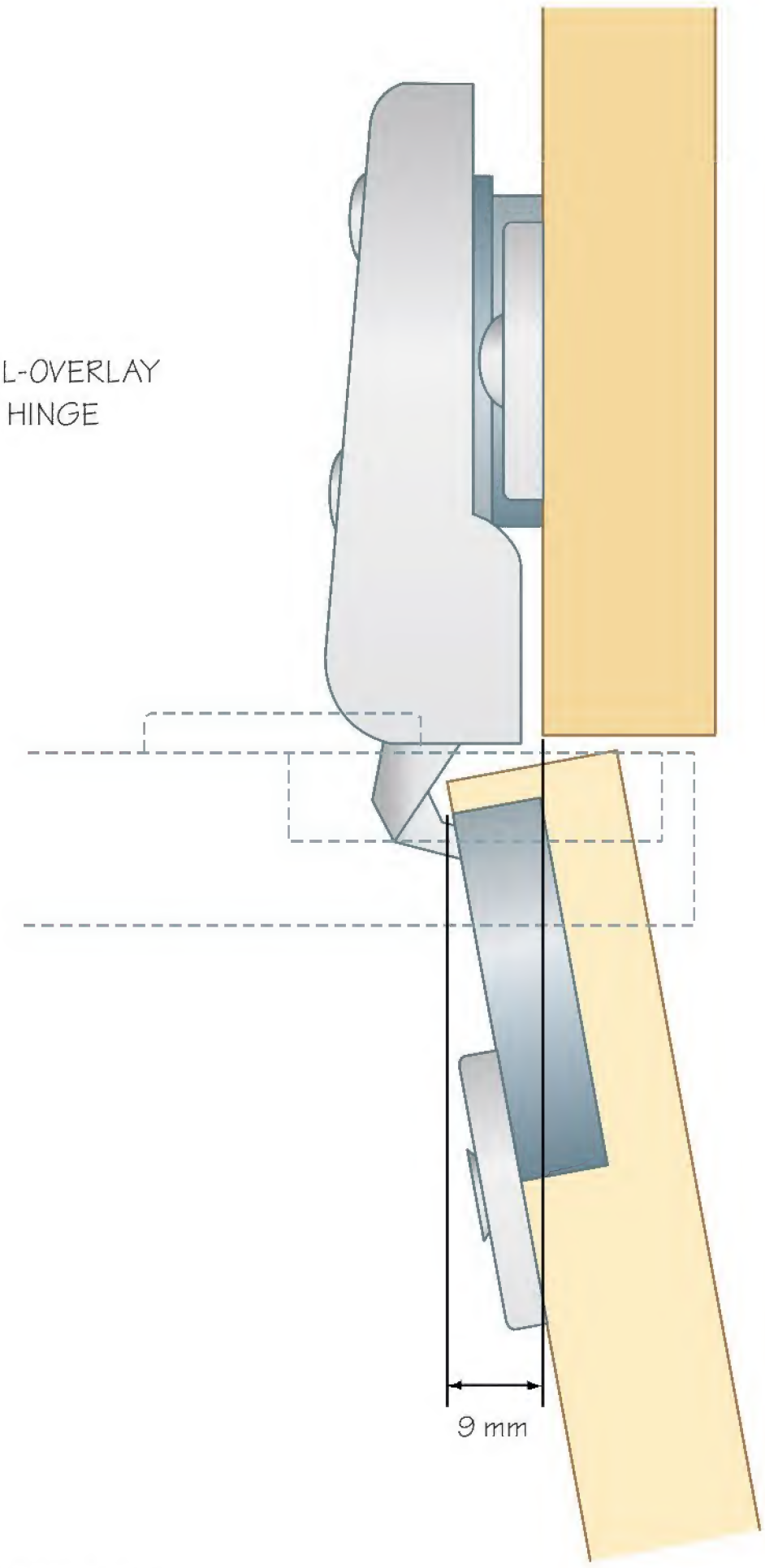
Hidden hinges are also classified in terms of degrees of opening. For standard door applications, the 100° to 120° opening hinge is common. You can also purchase hinges that will allow the door to open from 90° to 170°. The term simply refers to the number of degrees of swing allowed as the door opens from its closed position.







FULL-OVERLAY HINGE



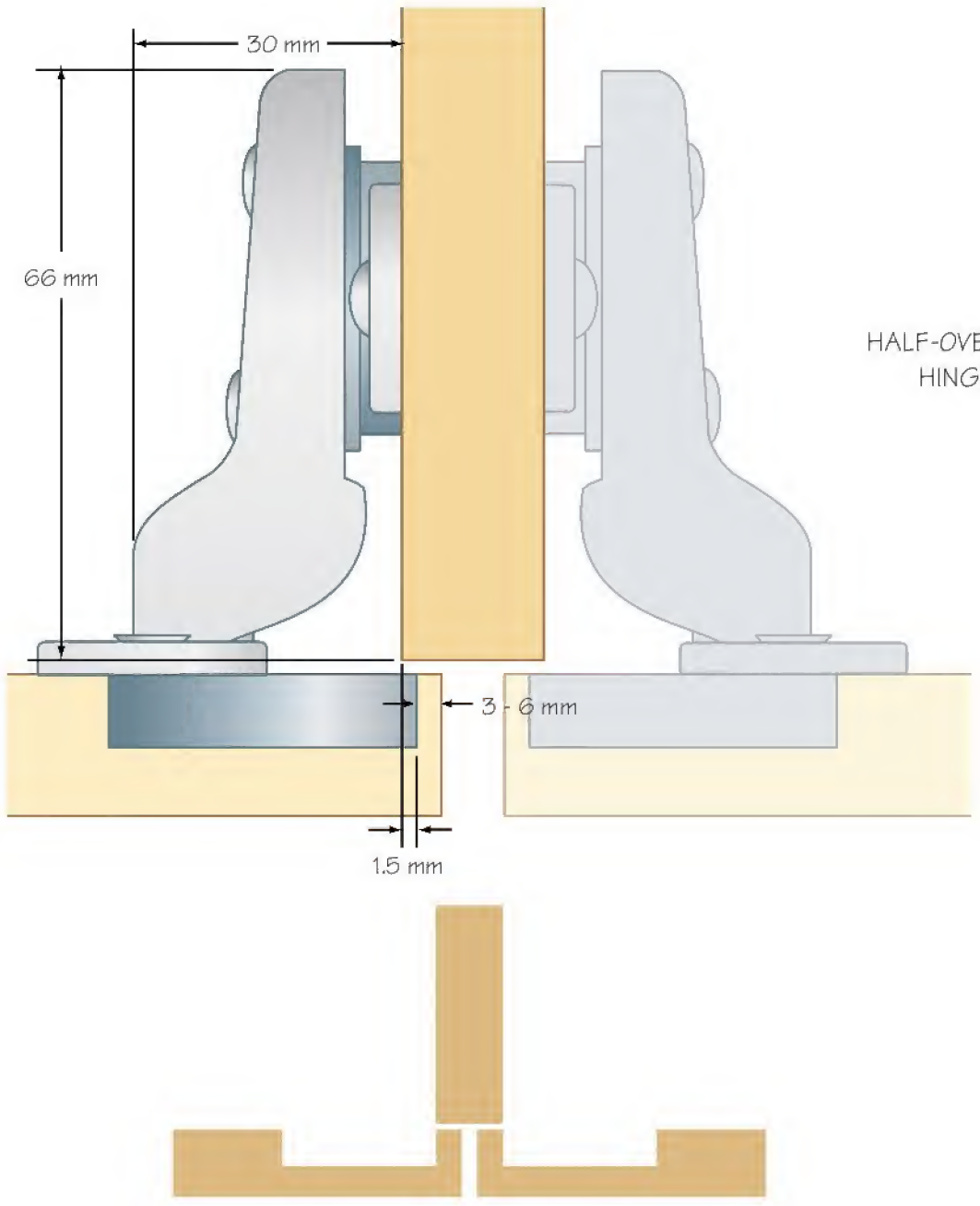
The Full-Overlay Hinge

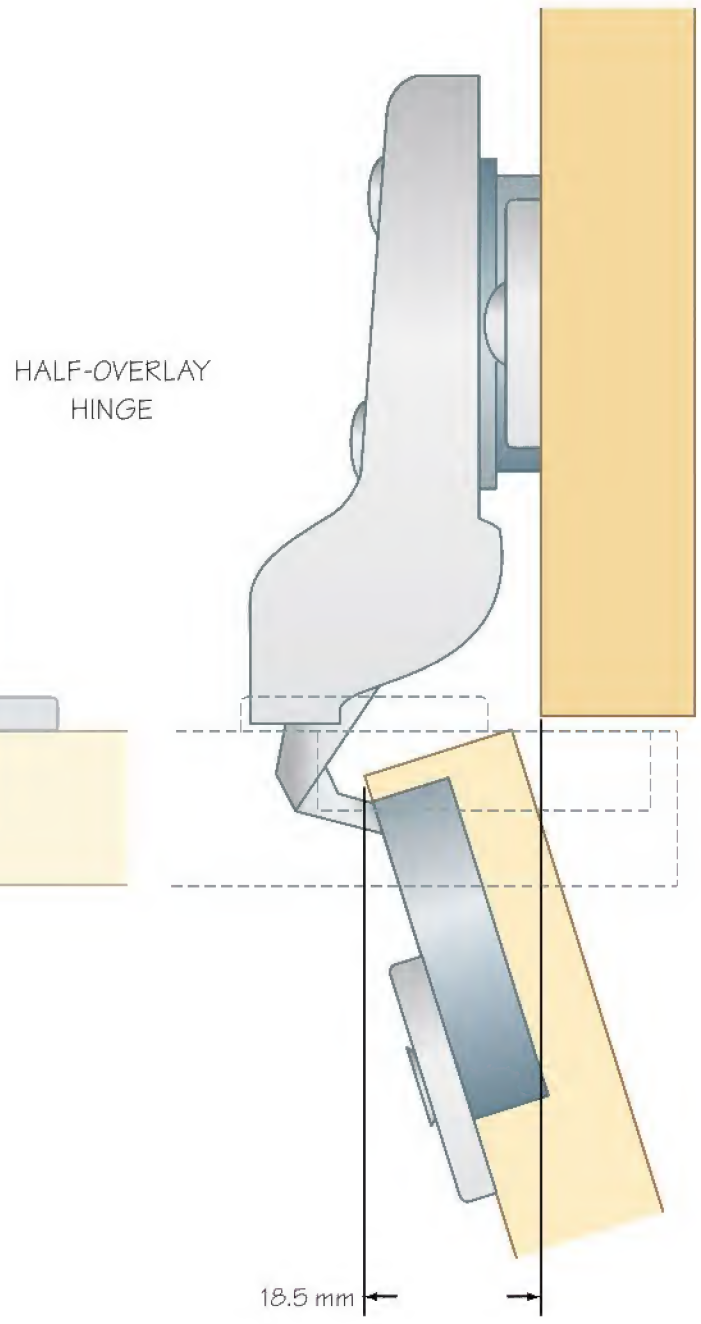
This figure illustrates a full-overlay hinge with the dimensions in millimeters. The door, when closed, almost covers the cabinet edge. That overlay distance is largely based on frameless European-style cabinetry that uses 16mm (⅝")-thick melamine-coated particleboard for kitchen-cabinet building.

Two 35mm-diameter holes are drilled in the door to accept the hinges. The holes are set back about ⅛" from the door's edge. Most manufacturers of door hinges — including the type I use — require this setup. However, check the specifications supplied by the manufacturer of the hinges you plan on using.

The depth of the hinge hole is dependent on the hinge. While there are slight variances, most hinges will fit in a hole that's ½" deep. Again, check the specifications with the hinge you plan on using.

The ideal bit for drilling a hinge hole is flat-bottomed, often called a Forstner bit or a hinge-boring bit. I suggest you use carbide-tipped bits because binding adhesives used to manufacture particleboard and plywood sheet goods are hard, as are most of the woods used in door construction. High-speed steel bits will burn very quickly when drilling these boards.





The Half-Overlay Hinge

The half-overlay hinge is identical to the full-overlay model with one slight difference; it mounts on the door in the same way but the cabinet side-edge overlap is only about 5/16", or one-half the full overlay.

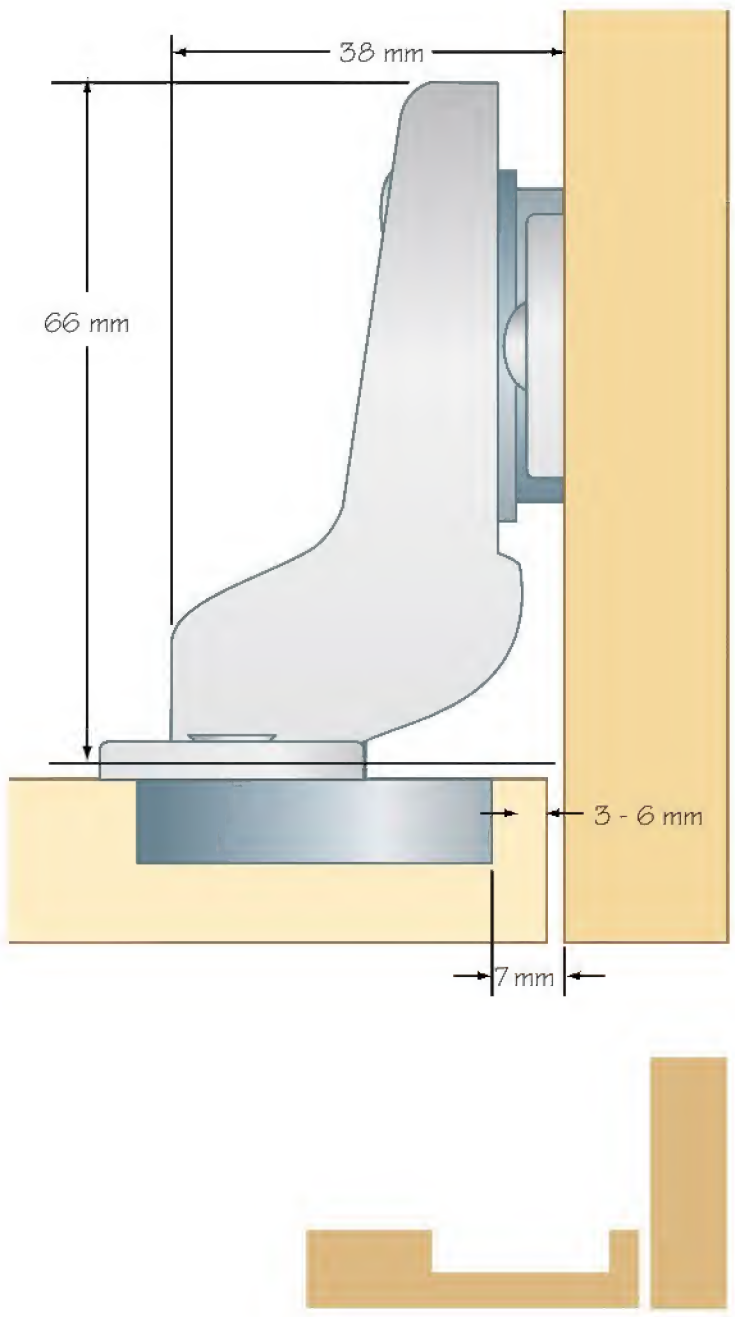
Manufacturers call this a half-overlay hinge but you might see it referred to as a twin or dual-application hinge. This hinge is used when two doors meet on one side or dividing edge. That application may arise when you have a series of doors, side by side in a run, and the center doors meet on one divider panel. It's a limited-use hinge, but there are times when the smaller overlay is needed.

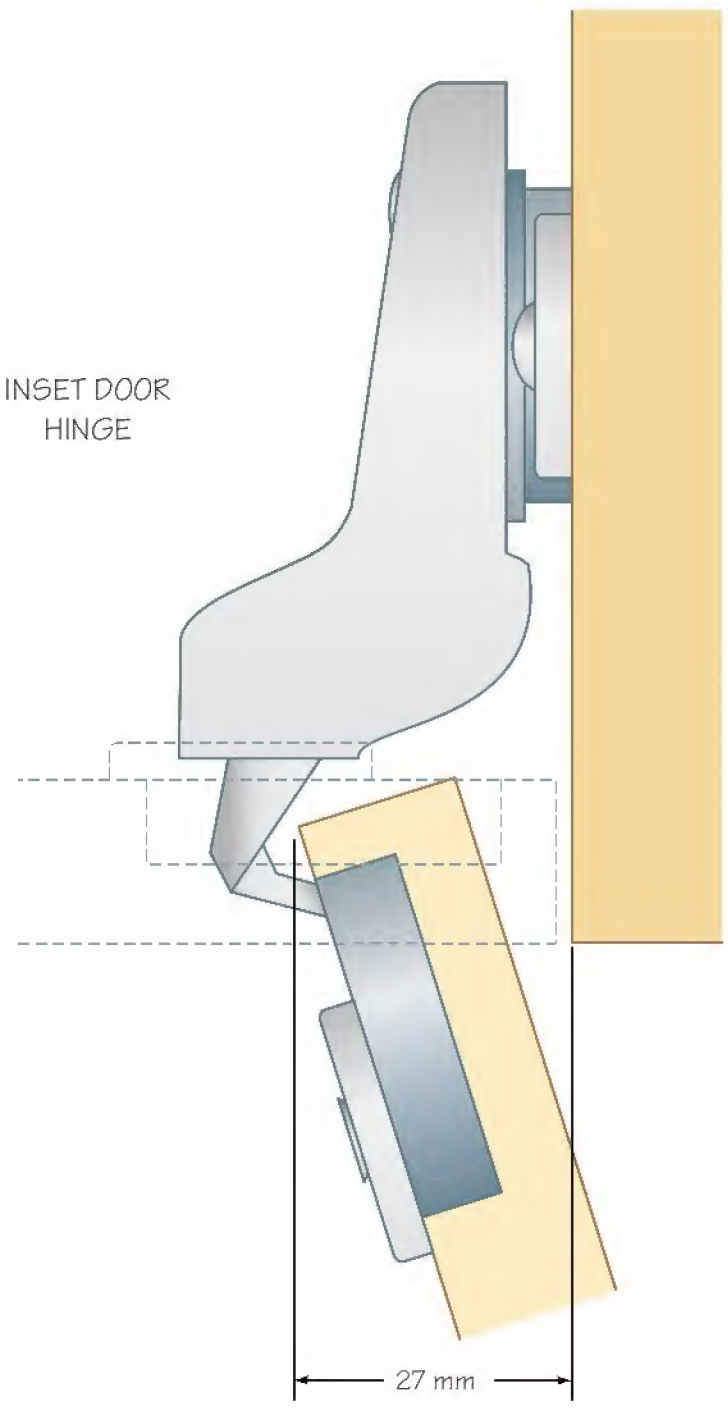
The Inset Hinge

The inset hinge is perfect for flush-mounted doors. The mechanical ability of this hinge in maintaining its position is an important feature. Unlike some of the earlier inset hinges and traditional North American styles, it's adjustable.

Building inset doors for any woodworking project is challenging. The cabinet opening must be square and the door has to be built with very close tolerances. Often, the clearance between the door and cabinet opening is 1/16" or less. A high-quality hinge is necessary for this application.

Study the specifications on the hinge you plan to use before building your inset doors. There are slight mounting variances, depending on the manufacturer; you should be aware of these before the doors are built.





Installing the Hidden Hinge

There are door-mounting jigs available at all woodworking stores. If you plan to use the hidden hinge for many of your projects, these jigs are very worthwhile. If you're using the hidden hinge only occasionally, here's a quick and easy installation method that does not require a jig.

This method works with all hinge-mounting applications. It's based on using a 95° to 120° standard-opening hinge. If you plan on installing a nonstandard hinge, such as the 170° model, install the door with a standard-hinge body mounted in the door, then replace it with a 170° body after the door has been hung.

1 First, drill the 35mm holes in the door for the hinge, ⅛" from the door edge. The holes are typically 3" to 4" from each end; it's not an important issue, so pick a distance where the hinge won't interfere with anything in the cabinet.

2 Secure the hinge body in the hole making certain it's at 90° to the door edge. Use ⅝"-long screws to anchor the hinge.

3 **ABOVE** Attach the mounting plate to the hinge body.

4 **RIGHT** Place the door on the cabinet in its 90° open position. A ⅛"-thick spacer, between the door edge and the cabinet side edge, sets the correct door gap. Insert screws through the mounting plate to secure it to the cabinet side.

5 **ABOVE** Remove the door by releasing the hinge bodies from the mounting plates. Insert the remaining screws in the mounting plates. This door-installation method will align the door in its proper position. All that may be needed are minor adjustments for a perfectly installed door on hidden hinges. If this is an application where you want to use a 170° wide-opening hinge, replace the standard-hinge body and install the door on the same mounting plates. The wider-opening hinge will also be correctly positioned.

Frameless Cabinet Door Sizes

If you plan to use the standard full-overlay hidden hinge, there's an easy rule of thumb to determine door size on frameless cabinets. The door height for upper cabinets is sized to cover both top and bottom board edges — the door equals the cabinet-box height.

Base-cabinet door heights, particularly with respect to kitchen cabinetry, are 1" less than the cabinet height. Countertop overhang can be up to ¾" below the cabinet's top board, so clearance is required. If the cabinet box is 31" high, not including the base frame, the door covers the bottom board edge and, at 30" high, leaves a 1" space at the top of the cabinet.

Door width is the critical issue. It's determined by first measuring the inside opening of the cabinet. Next, add 1" to that dimension to find the door width. For example, a utility cabinet that has a 21" inside opening measurement will need one 22"-wide door or two 11"-wide doors. It's that simple! You will have to adjust the hinges slightly to get the correct gap between doors. But as you'll discover, this simple rule works in almost all cases.

Face-Frame Cabinet Door Sizes

Face-frame cabinet boxes are built much like a frameless box. However, the box (carcass) has an applied hardwood frame on the front face. The carcass can be made of sheet materials such as plywood or particleboards. In old cabinets you might see solid-wood panels that have been glued together.

In some instances, the face frame's inside dimension is less than the inside carcass dimension. The cabinet's side board is set back from the inside edge of the face-frame vertical members (stiles). If that's the type of face-frame cabinet you're building or you encounter one that needs new doors, you can use traditional North American-style hinges or hidden hinges with a face-frame mounting plate. Either hinge will work fine.

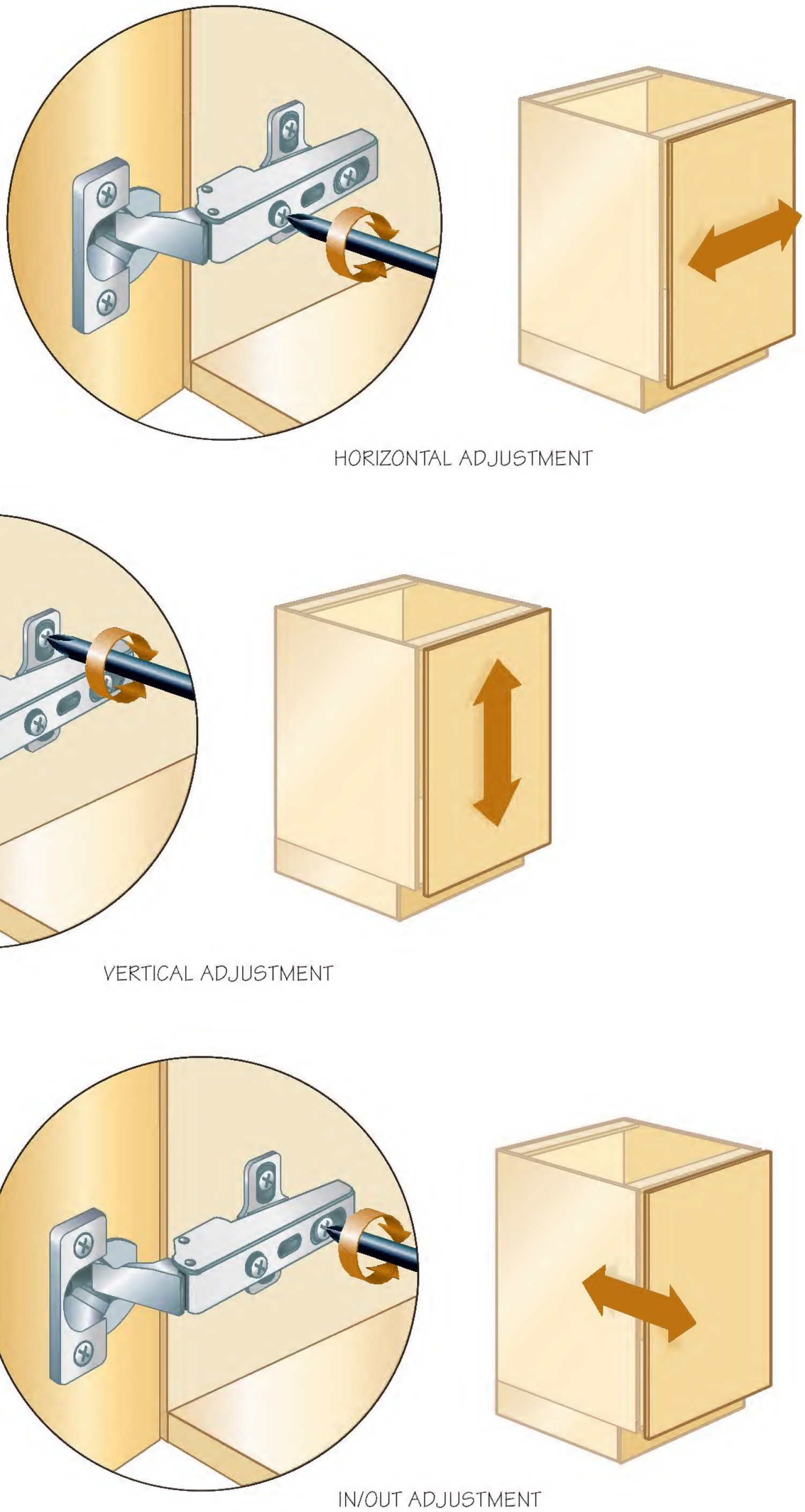
In the last few years, cabinetmakers — particularly in the kitchen cabinetmaking industry — have installed face frames so the inside edge of the face-frame stiles are flush with the inside face of the cabinet.

The measurement process for doors on face-frame cabinets is the same as frameless when using hidden hinges. Measure the distance between the inside stile edges of the face frame and add 1" to that dimension. That will determine cabinet door width.

The door height on face-frame cabinet uppers and bases is 1" to 1¼" less than the face-frame height. The door covers the bottom face-frame rail and leaves room at the top of the frame. Base units need the top clearance for countertop overhang and upper cabinets use the top free space for applied moldings.

Adjusting Hidden Hinges

Hidden hinges can be adjusted to move the cabinet door in three directions. The adjustment screw functions are fairly straightforward. With minor style differences, most hinges can be adjusted as shown in the illustration.



HORIZONTAL ADJUSTMENT

VERTICAL ADJUSTMENT

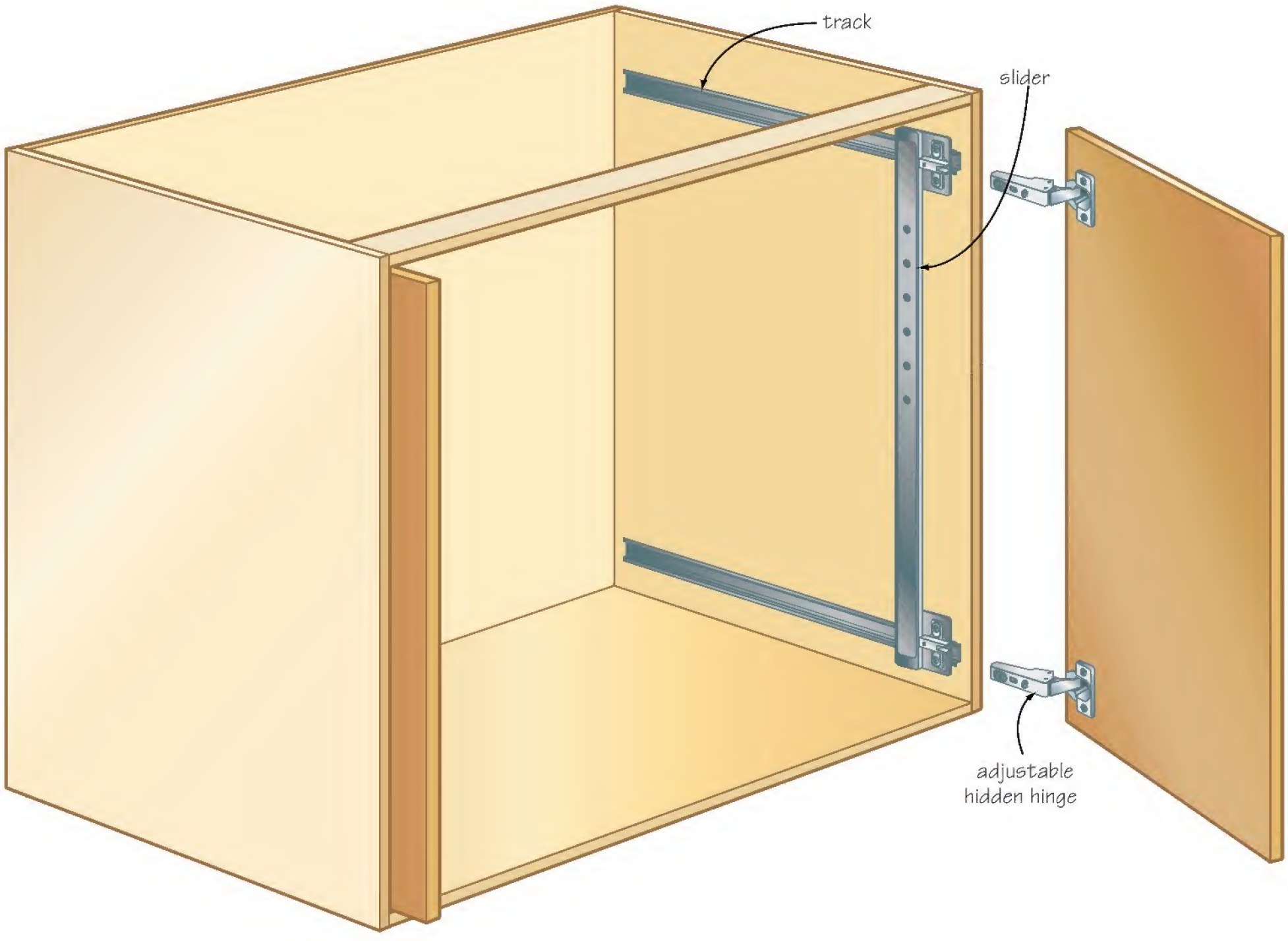
IN/OUT ADJUSTMENT

Wide-Opening and Bifold Hinges

There are many special application hinges, such as the 170° wide-opening hinge and the bifold hinge, which normally come with detailed installation instructions or technical specification sheets that are available from the hardware supplier.

Pocket Door Hinges

The pocket-door hinge system is another of the specialized hinges that will be fully described in this book. Pocket door hinge systems are often used when building television armoires. There are door-sizing and installation issues to deal with, but this is a fairly simple hardware system for hidden doors.



Drawer-Box Construction

There are dozens of methods used to build drawer boxes; I'll go through the step-by-step process for many of them in this book. The joinery used can be as simple as a butt joint or as intricate as a drawer lock or dovetail joint. There are also dozens of material choices for drawer-box construction, including melamine particleboard, Baltic birch plywood and solid wood.

Drawers used to be tracked on wood runners, so the material choice — as well as the construction style — was limited. However, the newer drawer-tracking hardware allows us to use more types of materials and different construction techniques.

Drawer Hardware

Modern drawer hardware has opened a great many possibilities for drawer-box design and construction. The white glides shown in the photograph are typical of the bottom-mount sets that are available on the market. They are often referred to as three-quarter drawer slides because they allow the drawer to be pulled out three-quarters of the set length. For example, a standard 22"-long drawer-glide set will let the drawer box travel about 16½". The silver set is a full-extension (FX) glide that allows full outward travel of the drawer box. The mechanics incorporated into the FX set are more involved, which is why these slides are approximately three times the cost of standard three-quarter glides.

These mechanical slides have improved drawer-box operation when compared to the old-style wood runners, and they are much more reliable. However, they do demand that you pay a great deal of attention to drawer-box sizing.

Drawer Box Size Calculation

The two cabinet styles, face-frame and frameless, each have formulas for calculating the correct drawer-box size. Most hardware requires a ½" space on both sides of the box to properly install the hardware. Page 142 will outline the steps so you can build boxes and drawer faces that fit — no matter which style of cabinet you build.

cabinet finishes

Many finishes are available on the market. They include paint and stains in any color imaginable, washed stains, polyurethane, oils and varnishes. Most finishing products are easy to apply and produce excellent results. However, check sample finishes on the type of wood you'll be using for your cabinets, and research all the properties. Check specifically for the product's hardness, resistance to stains from oils and grease, and its life expectancy. The finish will be subjected to a good deal of abuse in the kitchen from heat, moisture and handling.

The Internet is a good place to start your research on finishing products and techniques. Many major suppliers have information-based sites that are helpful. Some sites, such as the one run by the Hardwood Council at www.hardwoodcouncil.com, have on-line data and information brochures that you can order.

Preparing the Wood

The most important step prior to finishing the wood is to prepare it by sanding and cleaning. Sanding removes any of the power tool marks that occur during the planing and dressing stages of cutting lumber. As well, you may discover dents or gouges in your hardwoods that require repairing. Fill minor abrasions with one of the many wood fillers on the market and prepare the wood as instructed on the container. If the gouge is serious, I'd consider replacing the piece, as it may be more trouble to try to repair the damage. For most filling, such as nail holes and very small gouges, I use a colored wax filler that will match the final finish.

Sanding

Begin sanding with a course paper, such as 100-grit, then move up to 150-grit and finish sanding with 180- or 220-grit paper. I use the 100- and 150-grit papers on a random-orbit sander for most of my work, as it leaves few sanding marks and can be moved in any direction. The final sanding is done by hand with 180-grit paper.

Remember to be careful with glue on the joints, as it blocks the finish from penetrating into the wood and can leave a noticeable mark. It's best to wipe up the glue with a dry rag while it's still wet.

Using Clear Natural Finishes

In the last few years about 80 percent of my kitchen cabinets have been finished with clear satin or semigloss oil-based polyurethane. The majority of clients seem to prefer the naturally finished wood cabinet. I have also finished a few kitchen projects using the semitransparent washed stains that are easy to apply and produce excellent results.

Large cabinet shops often use lacquer finishes on their cabinet work. They apply the lacquer in spray booths with a paint compressor. These produce an excellent finish that dries quickly, allowing a two- or three-coat application over a short time period. The spray booth method requires a large space with special ventilation and is beyond the means and space availability of most woodworkers. Some shops specialize in finishing and you may want to use their services, if one is locally available.

Wood finishing is an art that takes practice and experience. I have tried many finishes and methods over the years, only to realize that there is much to learn in this field. I have taken finishing courses and read books on the subject. Good sources of information can be found in woodworking magazines. You will find numerous finishing manuals for sale, as well as many excellent articles on specific finishing techniques in these magazines.

Applying Polyurethane

As earlier stated, my preference over the last few years has been to apply oil-based polyurethane. I normally apply three coats with a good-quality brush, the first coat being thinned slightly, then I sand with 220-grit paper between each coat. The clear satin polyurethane produces a hard finish that doesn't readily show grease or fingerprints and is relatively easy to use.

cabinet installation

Cabinet installation methods vary depending on the installer. The primary difference is whether to begin by installing the uppers or the bases. Each method has its merits, as there is no absolute correct way of installing cabinets. Find a process that you are comfortable with to achieve the end result: properly installed cabinets. I will describe my method of cabinet installation based on our sample kitchen layout at the beginning of the book.

Existing Cabinet Tear-Out

Unless you're building cabinets for a new home, you'll be faced with tearing out the existing kitchen cabinets. And unless they are reasonably modern cabinets, you'll most likely find they were built in place.

Carpenter or stick built-in-place cabinets depend heavily on the structural support from existing walls. Therefore, finding fastening devices such as screws and nails can sometimes be quite a challenge. I've seen every fastening device under the sun when tearing out existing cabinets. It can be fun to see various support systems that have been installed.

Be careful and take your time tearing out old cabinets. Electrical wiring is often hidden, plumbing is sometimes routed through cabinets, and heating ducts may have been directed under the existing base cabinets.

In the interest of safety, I suggest you turn off the water supply and electrical service to the kitchen area, as well as other nearby rooms. This safety measure will help avoid accidents or damage should you inadvertently break a water line or cut a power cable.

Site Preparation

Site preparation prior to new cabinet installation is an important process. Verify that water and waste supply lines are in the correct location, and that electrical service is sufficient and correctly positioned. If you plan to move the sink location, now is an excellent time to reroute supply lines. The frameless and face-frame cabinet building systems detailed in this book incorporate a full backboard on both upper and lower units. Therefore, you can remove wall sheathing to allow changes in supply line positioning.

The same is true with electrical service lines. Verify that outlets are in the correct location and at the correct height. Base cabinet height is 36", but you must also account for the height of the countertop backsplash, which can often add an additional 4" to the overall base height.

Use a long level or straightedge to check the wall condition. You'll never find a perfect wall, but a wall stud that has badly bowed over time can cause problems during new cabinet installation. If you find a bad bulge in any of the walls, remove the sheeting and correct the problem.

The Starting Point

You should be aware of some considerations before proceeding. Often a room is out of square and walls are not plumb. This can cause a number of problems during cabinet installation.

In our sample kitchen, I will go through the process as described, checking the room dimensions for cabinet runs that are between walls. For example, referring to the drawing in chapter twelve, the N to L base cabinet run is between two walls, so verify that your space requirements are correct as you install each cabinet. It's possible for the wall at L to be out of plumb enough that your cabinet will not fit. Hold your level vertically on the wall to determine if the wall is out of plumb. It's best to test fit your cabinets prior to anchoring them permanently in place.

In our sample kitchen, the upper cabinet runs are both closed runs. This is typically the most difficult installation. In this situation I would start in the corner with cabinet E and work out to both sides, always checking my remaining distances to avoid any serious problems. It can be frustrating if you have to remove installed cabinets to plane a face frame because you've run out of space.

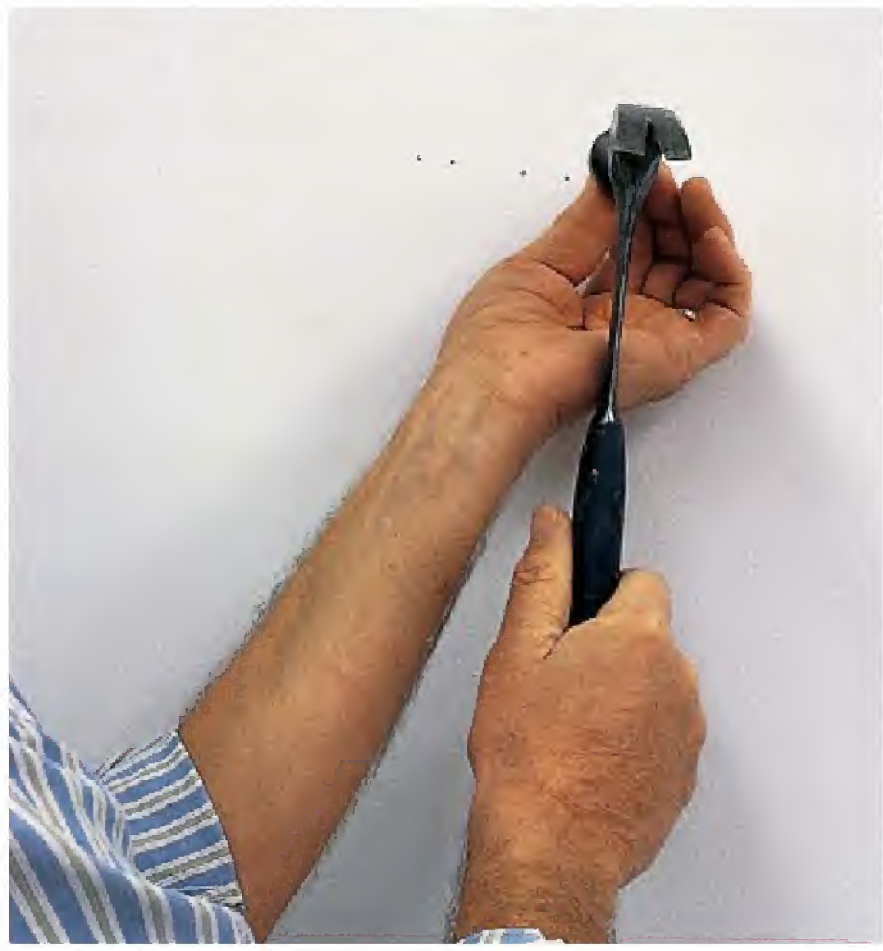
The first step in cabinet installation is to determine the level or slope of the floor and how much the walls are out f plumb. This is your biggest challenge when installing kitchen cabinets. When wall are out of plumb, adjustable cabinet legs allow for easier installation as compared to the constructed base support assembly system. And the overhang of the face frame allows room for scribing cabinets to an out-of-plumb wall.

Draw a level line on the walls around the room at a reference height of 35¼" from the floor. After drawing the line with a level, measure from the floor to the line at various positions around the room. Determine the highest point in the room. (It will be the place with the smallest distance from that level reference line to the floor.) Start your base cabinet installation from that high point, setting the top edge of the base at 35¼". That height, plus the thickness of the countertop material, will set the top surface at the required 36" above the floor.

All floors have a slope, some greater than others, and it's important that you determine the high point. If you start installing cabinets in an area other than the high point, you may not have sufficient adjustment range on the legs.

Locate the Wall Studs

1 Use a wall stud finder to locate the first and second stud.



2 Drive a small finishing nail into the mark and locate the outer limits of the studs. Mark the centers of both studs.

3 Measure the distance between studs and mark the stud locations around the room. You may want to check the locations with your stud finder to satisfy yourself that the stud center-to-center distances are staying constant.

4 Use a long level to extend the stud lines below the upper cabinet position and above the base cabinet tops.

5 Support the upper cabinets with blocks or a strong wooden box prior to removing screws or nails. The sudden weight shift downward when the last fastener is removed can be surprising. Always, if possible, enlist the help of someone to stabilize the cabinet as you remove the fasteners. Again, with respect to upper cabinets, remove all loose assemblies, such as shelves, to lighten them. You'll also avoid the danger of having shelving fall on you should the cabinet suddenly tip. I remove the cabinet doors before taking the fasteners out to further lighten the load.

Removing base cabinets can be hazardous even though they appear to be sitting on the floor. Rotten floor support systems or poorly connected kick platforms may cause the base cabinet to fall forward when the last screw is removed. Again, enlist the aid of another person to support the assembly when removing fastening devices.

Installing the Cabinets

1 Install a base cabinet at the highest point in the room. If you cannot start at the highest point, be aware of the adjustment limits with the cabinet legs. Level that base cabinet and anchor it to the wall with 3" screws into the studs. Four screws per cabinet are more than enough to firmly secure the base units.

After the first cabinet has been installed, continue in either direction, leveling and securing the cabinets. The procedure changes slightly with the second cabinet. For frameless cabinetry, join the front edge of the second cabinet flush with the first cabinet's front edge and secure with 1" screws through the cabinet sides. When installing face-frame cabinets, join the stiles together and use 1¼" screws through the stiles. Now anchor the back of the cabinet to the wall.

2 When installing face-frame cabinets, remove the doors and clamp the left-side stile of one cabinet to the right-side stile of the adjacent cabinet. Be sure the face frames are flush with each other.

Drill a ⅛" countersunk pilot hole through one stile and partially into the other. Drill a hole slightly larger than the screw body thickness through the stile on the screw-head side to allow the screw to rotate freely in that stile to prevent bridging (the effect caused when the screw threads into both pieces of wood being fastened, preventing the pieces from being drawn tightly together). Fasten the stiles together with three 1¼" screws at the top, middle and bottom. Then anchor the cabinet to the wall with 3" screws through the backboard and into the wall studs.

3 The same procedure holds true for frameless cabinets, except they are tied together with 1" screws or double-headed bolts at the front edge.

4 All cabinets, particularly the first upper and base, must be plumb. Use a long level to read the position, and shim the cabinet into plumb if necessary. A small fraction out of plumb will cause a great deal of trouble, particularly on long runs of cabinets.

5 A level cabinet is equally important. Use a good level to properly locate the cabinet before it's permanently anchored to the wall.

6 You may be required to scribe the stile if it isn't tight against the wall or the countertop to achieve a snug fit along the wall contours. Check the fit after leveling the cabinet and use a compass, adjusted to the widest part of the gap, between the wall and stile, as your reference. Holding the point of the compass against the wall, draw a pencil line on the stile face. Use a sharp plane and remove wood up to the pencil line until you get a tight fit. You may find that a belt sander does the job when you have many contours in the wall.

The same process holds true for countertop fitting. A countertop usually requires scribing and fitting as most walls are not perfectly flat. Draw the line and use a belt sander to remove material.

7 Install the remainder of the base cabinets in the same manner. With respect to the sample layout, set the stile-to-stile spacing between cabinets K and J at 31". This will provide clearance for a ⅜" countertop overhang on cabinet K and J and leave a 30¼" space for the stove.

8 Install the countertop, scribing and removing material if necessary, so that the countertop fits tightly against the wall. Overhang the small countertop on base cabinet J by ⅜" on each side. Use ⅜" screws in the brackets to secure the countertop in place.

9 Attach the upper cabinets to the wall with four 3" wood screws through the backboard into the wall studs. The first cabinet must be level and plumb, as it's the reference point for all the upper cabinets. Verify your remaining space after installing each cabinet. With regards to our sample kitchen, cabinets A and H will probably require stile scribing to get a perfect fit.

Install the remainder of the upper cabinets, being sure they are well supported. Level the cabinets, screw the adjoining stiles to each other and anchor the cabinets to the wall. The bottoms of the stiles must be even on the cabinets. Reduced-height cabinets (cabinets G, C and A) should be installed with the cabinet tops in line with the top edges of the other upper cabinets.

10 **LEFT** Install veneer plywood on the underside of all upper cabinets with either contact cement or brad nails. I have also successfully used high-quality construction cement, which is much quicker to apply than contact cement.

11 **RIGHT** Cut to size and install trim moulding on the top edge of the upper cabinets. Any errors in stile length cutting or gaps between the stiles can be left at the top of the cabinets and will be covered by the moulding. Trim moulding style is dependent on individual taste. I've installed everything from 1" bead to 4" crown moulding to achieve different finished appearances. Purchase short lengths of a number of moulding styles

Installing Appliances

Installing appliances is always challenging. Always verify your appliance dimensions before beginning the kitchen design process. One common point of frustration in the kitchen cabinetmaking industry is with ranges. Many cabinetmakers leave 31" of space between lower cabinets for range placement. This allowance provides for ⅜" countertop overhang on each cabinet side and ¼" clearance between the countertop sides and the range for easy removal and replacement during cleaning. However, range hoods, which are installed above the range, are exactly 30" wide and look properly installed when there isn't any space on either side. The simplest way I've found to overcome the problem, and to have the upper and lower cabinets align, is to add ½" to each upper cabinet stile on either side of the over-the-stove cabinet. The upper stove cabinet, being 30" wide, will allow installation of the range hood without space on each side. The added stile width (now a 1½" stile), on each of the upper cabinets to the right and left of the upper stove cabinet, will force them in line with the lower cabinets. This added stile width is only on the upper cabinet's side that butts against the upper stove cabinet.

Completing the Cabinet Installation

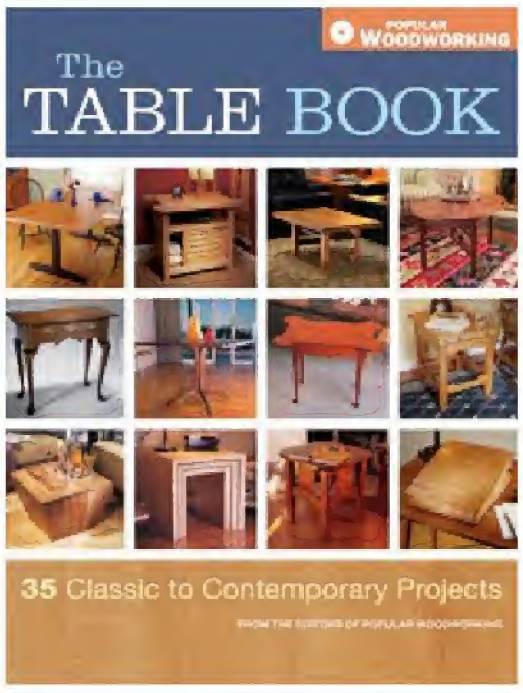
It's important that you avoid racking (twisting) the cabinet during installation. Most walls are not straight. Many have irregular surfaces and are not plumb. When anchoring cabinets to the wall, verify that the cabinet back is touching the wall, and if there is a gap, use a shim to fill the space. I find cedar shims work well because they are tapered. Always check the level, front to back and side to side, as well as the plumb of each cabinet before and after you anchor it securely.

Cut the kickboards to length, install the plinth clips and secure the boards to the cabinet legs. Use butt joints where the kickboards intersect at right angles. If the floor is out of level, you may have to scribe the bottom of the kickboard to get a tight fit. Alternatively, you can use quarter-round moulding, which is flexible, to fill the gaps between the floor and the kickboard. Simply nail the quarter-round to the kickboard while holding it tightly against the floor.

Install doorstop moulding around the perimeter on the exposed base and upper cabinet sides. Use mitered corners with the moulding to form a perimeter picture frame. This adds visual depth to the cabinet ends. As well, any wall irregularities can be hidden, as the moulding is slightly flexible and can be pushed into the contours of the wall. It's best to cut and install one moulding piece at a time to give you the tightest fit possible.

ideas. instruction. inspiration.

These and other great **Popular Woodworking** products are available at your local bookstore, woodworking store or online supplier.

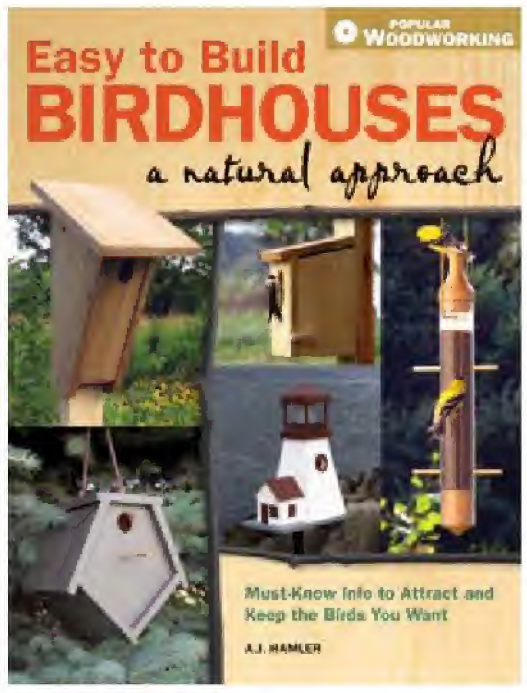


THE TABLE BOOK

FROM THE EDITORS OF POPULAR WOODWORKING

You'll find a table in every woodworking style to fit your needs and individual tastes. And, while building the projects, your woodworking skills will be challenged and improved!

ISBN 13: 978-1-4403-0427-9
paperback • 272 pages • Z7128



EASY TO BUILD BIRDHOUSES

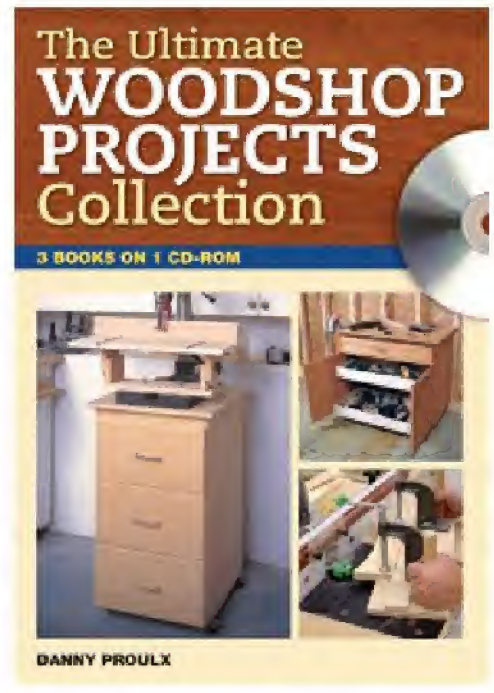
BY A.J. HAMLER

Projects range from traditional designs to a lighthouse, a cottage and a football helmet and more! Fun to build and fun to watch the birds move into their new home!

ISBN 13: 978-1-4403-0220-6
paperback • 144 pages • Z5979

POPULAR WOODWORKING MAGAZINE

Whether learning a new hobby or perfecting your craft, *Popular Woodworking Magazine* has expert information to teach the skill, not just the project. Find the latest issue on newsstands, or order online at www.popularwoodworking.com.



THE ULTIMATE WOODSHOP PROJECT COLLECTION

CD-ROM, BOOKS BY DANNY PROULX

This CD-ROM gives you all the information you need to make your shop the best it can be.

ISBN 13: 978-1-4403-0241-1

This disc includes the full book content from: *Building Woodshop Workstations*, *Toolboxes & Wookbenches* and *50 Jigs & Fixtures*. CD-ROM • Z6474

Visit **www.popularwoodworking.com** to see more woodworking information by the experts.

A woodworking education can come in many forms, including books, magazines, videos and community feedback. At Popular Woodworking we've got them all. Visit our website at www.popularwoodworking.com to follow our blogs, read about the newest tools and books and join our community. We want to know what you're building.

Sign up to receive our weekly newsletter at http://popularwoodworking.com/newsletters/

WOODWORKING

Cabinets are just boxes. Keep it Simple!

Yes, cabinets are those things that make up the storage in a kitchen. And they are the built-in storage spaces in your bathroom, den and other rooms. But cabinets are also free-standing storage units like bookcases. Building cabinets is really building boxes and there are simple techniques to create solid, quality cabinets that look great.

Learn easy steps for making doors and drawers for your cabinets; how to make counter tops, install hardware and more.

UPC 0 35313 65335 3

W0715 US $24.99 (CAN $28.99)

ISBN-13: 978-1-4403-1305-9
ISBN-10: 1-4403-1305-9

52499

EAN 9 781440 313059